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PREVENTIVE MEDICINE AS APPLIED TO PULMONARY TUBERCULOSIS.

by

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I N T R O D U C T I O N.

This Thesis is the outcome of several years' practical experience in all aspects of the tuberculosis problem. Having been Resident Physician at a Sanatorium, Medical Officer to a Tuberculosis Dispensary, and a Research Scholar in the scientific side of Tuberculosis, I feel that I have seen almost every view of the question. When to this is added my experience in practical sanitation gained as Assistant Medical Officer of Health for the Boroughs of Leith and Derby, and for the City of Lincoln, I feel that I am in some degree qualified to express an opinion on the public health aspects of the disease Tuberculosis.

In the course of this Thesis there will be included several pieces of original work, in addition to a digest of a considerable amount of literature on the subject. The main part of the thesis, however, will consist of the exposition of views which I have come to regard as essential to the success of any campaign on the part of the public health authorities against the disease Tuberculosis.

H I S T O R I C A L.

A short summary of the history of Tuberculosis especially with reference to the infectivity of the condition and to the now recognised open-air method of treatment will be of interest.

The disease Tuberculosis was known to Hippocrates (B.C.460-377) whose writings contain a description of the disease so correct in its essential details as to equal a work of modern excellence.

The name of Henry McCormac of Belfast occurs to the mind at once as being that of the pioneer of the open-air treatment. His first work appeared in 1855. Although scoffed at to a great extent in his own days, his methods and ideals are those in every day use at the present time for the cure of tuberculosis of the lungs. Again, one George Bodington in 1840 published a book on "The treatment and cure of pulmonary Consumption", in which he advocated an open-air life in all weathers, and good feeding.

The sanatorium was first put on a thoroughly practical basis by Hermann Brehmer at Göbersdorf in 1859.

With regard to the infectivity of tuberculosis history goes back far beyond the days when open-air treatment began to be discussed. Aristotle is said to have believed in the infectivity of Consumption as also did Galen (130-200 A.D.).

In the early part of the 18th Century stringent

Enactments as to notification and disinfection in cases of phthisis, were made in Barcelona and Saragossa. About the middle of the same century the Florentine authorities forbade spitting by consumptives. In 1772 the Sacra Consulta of Rome forbade the sale of clothing of consumptives. In 1865 Villemin published the result of his investigations on the nature of the disease tuberculosis (1), and later, in 1868, he published a more complete paper on the subject.(2). It was he who first placed the infective nature of tuberculosis on a solid experimental basis.

In 1870 to 1880 Armanni and Cohnheim demonstrated the infectivity of tubercle by the inoculation of tubercular material into the eye of rabbits.

It remained for Robert Koch in March 1882 (3) to make the announcement of the discovery of the tubercle bacillus and to finally establish beyond dispute that phthisis is an infectious disease.

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(1) Villemin "Cause et Nature de la tuberculose" Bulletin de l'Academie de Medicine. 1865

(2) Villemin "Etudes sur la Tuberculose".

(3) Koch. "Die Aetiologie der Tuberculose" Mittheilungen aus dem Kaiseri. Gesundheitsante Bd. II 1884. + Berliner Klinische Wochenschrift, 1882

THE DISEASE TUBERCULOSIS.

Some considerations bearing on this disease from the Public Health standpoint.

The Prevalence of The Disease.

Consumption is universally regarded as the most dreaded scourge of the human race.

One seventh of all deaths in civilized countries are reported to result from this disease, and in addition an enormous proportion of individuals harbour unconsciously latent foci of infection.

In this country phthisis is the cause of death of upwards of 60,000 persons annually.

Naegeli's statistics obtained as the result of 500 post-mortem examinations at Professor Ribbert's Institute in Zürich, are as follows:- Up to the fifteenth year of life he found tubercular lesions healed or otherwise in 97% of the cases examined. Up to the 18th year he found them in 96% and in nearly 100 % up to the 40th year. It used to be an old English idea that consumption was the cause of death of nearly all hard workers in the field of letters, law, love, medicine and religion.

For England and Wales the following are the exact figures: during the decennial period 1881-1890 (1)

Total deaths from all causes	5,244,771
Deaths from Phthisis	473,968
Deaths from other tubercular & scrofulous diseases	115,422
making the Total from all tubercular diseases	589,390

(1) Quain's Dictionary of Medicine.

From these figures it is evident that 1 out of every 11 deaths in our own country was caused by Phthisis, and 1 out of every 9 by tubercular diseases in general.

The phthisis mortality in England and Wales for the years 1851-1900 (per 1000 living) was:- (2)

Decennia.	Males.	Females.	Total.
1851-1860	2.6	2.8	2.7
1861-1870	2.5	2.5	2.5
1871-1880	2.2	2.0	2.1
1881-1890	1.8	1.6	1.7
1891-1900	1.5	1.2	1.3

It is in a small measure satisfactory to know that the death-rate from phthisis is taking a steady tendency to fall within recent years. Thus, in London in 1884 the death-rate was 3.12 per 1000 population, while in 1901 in was only 2.34. Likewise, Berlin shows a decrease from 3.6 to 2.3 and Vienna from 7.2 to 4.7.

In estimating the prevalence of tuberculosis all the figures given above deal with deaths and death-rates: no attempt has been made to guage the amount of tuberculosis existing among the living. On this account I determined to endeavour to form if possible some estimate of the prevalence of actual living cases of tuberculosis in the town in which I was living, namely Derby.

Derby is essentially a working class town having a population of 130,000 and thus, while small enough

(2) Registrar-General's Report, 1901.

to render such an estimation possible, it is sufficiently large to make the figures recorded of some value.

The methods which were utilized are detailed below and as, so far as can be found, no similar endeavour has been made in any other town, it may be as well to fully explain how each method was worked.

METHOD I. By circularising all the medical men in general practice in the town, also all hospitals to which consumptives are likely to apply for medical treatment.

In November 1910 a letter was addressed to each medical man and each hospital, asking the following questions:-

1. How many cases of definite pulmonary tuberculosis are you at present attending?
2. How many cases of suspicious pulmonary tuberculosis are you at present attending?
3. Of the above cases, how many are living under bad social conditions?

The replies sent in were fairly satisfactory in point of numbers. Out of 48 medical practitioners, replies were received from 34, while all the hospitals sent in returns. In order to get an approximate figure, the returns from the 14 doctors who did not reply were taken as equal to the average for the 34 who did reply.

The results were as follows:-

From General Practitioners	186
From Hospitals	97
From School Medical Officer	70(approx:)
Total.	353.

The return from the School Medical Officer can only be stated approximately as only those cases are counted which to his knowledge are not under medical treatment from doctors or hospitals in the town.

This method did not yield as large a number of cases as I anticipated and I am convinced that there must be a large number of cases of phthisis in the town which are not under medical treatment in any form.

METHOD II.

By means of the medical inspection of school children.

It was not hoped that by this method one would discover all or nearly all of the cases in the town, but I was convinced that from it one could get a minimum figure.

By knowing the number of cases of phthisis out of a known number of cases examined, one could then calculate the probable number in the schools as a whole. Records were also obtainable of all near relatives of these cases who were afflicted with phthisis, and these were added to the number of children. The results are shown below:-

No. of children examined.	No. of do. with phthisis.	No. of relatives with phthisis	Total
9534	82	31	113

The total number of children on the books of the Derby schools in September 1909 was 21154 -

$$\therefore \quad \frac{113 \times 21154}{9534} = 251$$

Number of cases of phthisis estimated by this method.

The obvious fallacy of this method is that it cannot take any account of the number of cases of phthisis in the town who are unconnected with a school child. It gives one, as I pointed out above, merely a minimum figure.

METHOD III.

By means of the two systems of notification of phthisis in force in Derby, namely, Voluntary Notification and the Notification of Poor-Law cases under the Public Health (Tuberculosis) Regulations 1908. The figure obtained from these sources (1) for the year 1909 was 127.

This obviously falls far short of either of the previous methods in point of numbers.

METHOD IV.

Dr. R.W. Philip (2) considers that roughly the number of cases of moderately advanced phthisis in a town may be calculated by multiplying the number of deaths per annum by ten.

Adopting this method for Derby in 1909, we get,

129 x 10, = 1290

This method thus gives a figure much in advance of any of the previous methods, and, from what I have personally seen during a considerable amount of work amongst the poorer classes in Derby, I am inclined to the view that the last figure, namely 1290, is much nearer the truth than the others.

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(1) Annual Rept. of M.O.H. for Derby 1909 p.64.
(2) "The Organisation of the Home Treatment of Pulmonary Tuberculosis" Brit:Med:Jour:11th Ju.1904

These methods are put forward as being of considerable interest from a public health point of view and also for the fact that they demonstrate the enormous difficulty to be met with in endeavouring to get a satisfactory estimate of the number of cases of phthisis in any community.

To emphasize this question of prevalence, it is worthy of particular notice that in England roughly one fourth of all deaths occurring during the period of useful activity are reported to result from Consumption.

AGE DISTRIBUTION.

No sex or age is exempt from the ravages of the disease. In young children the bones, glands and alimentary canal are chiefly attacked, while in the adult pulmonary tuberculosis is far more frequent. The age at which the greatest mortality from pulmonary tuberculosis is seen differs somewhat in different countries, but in England the maximum occurs between the ages of 35-45, that is to say at the ages when loss of working capacity inflicts the greatest economic losses upon the Community. When a child is attacked by an acute disease, such as measles, or an adolescent by enteric fever, the resulting economic loss as regards work is little or nothing and in any case is temporary, while loss of the child by such disease is a loss of potential wealth alone. When, however, a married man with children is attacked by a chronic disease such as pulmonary tuberculosis, diminished working capacity or absolute inability to

work at once ensues; and his wife and family are consequently liable so far to suffer from insufficient nourishment as to become then, or subsequently, a partial charge upon the rates or upon charity.

The following table (1) is of interest as showing the age distribution of phthisis in England & Wales:-

Phthisis Mortality at age groups.	Average 1900-1904.	Year 1905
0 -	341	348
5 -	176	162
10 -	299	261
15 -	902	850
20 -	1448	1300
25 -	1855	1695
35 -	2293	2007
45 -	2274	2064
55 -	1802	1689
65 -	949	785

SEX INCIDENCE

If we study the statistics on the incidence of phthisis, a somewhat interesting situation is created with reference to the affection of the sexes. From 1851 to 1863 the greatest incidence of the disease was upon females; from 1864 to 1868 the incidence was practically the same in both sexes, and since 1868 the incidence among males became markedly more than amongst females. At the present time males suffer to the extent of about 4 deaths per 10,000 more than females.

No satisfactory theory has as yet been advanced to account for this varying sex incidence.

Occupational conditions are frequently advanced as a reason for the greater incidence amongst males at the present time, and without doubt there are certain

(1) "Memorandum on Mortality from Tubercular Phthisis in England & Wales during the last forty years" by John Tatham. Transactions of British Congress on Tuberculosis, Vol.II, 1902.

occupations which tend to render the worker therein peculiarly prone to develop pulmonary tuberculosis. As example of this we have only to consider the amount of phthisis prevalent amongst Cornish miners and Sheffield grinders.

The statistics of certain sanatoria bring out an important point, namely that both the immediate and the after results of treatment are better in the cases of females than of males. and from my own personal observation at the Royal Victoria Hospital for Consumption I certainly endorse this view.

In England, Wales, and Scotland the tuberculosis death rate amongst females has fallen at a more rapid rate than amongst males.

To one interested in public health, there is a very gratifying aspect to this lower female incidence of phthisis, namely, that as the female is essentially connected with the home and home conditions, it follows to a certain extent that diminished incidence of phthisis amongst women means improved home conditions and improved sanitation and ventilation. One is sometimes tempted to lose sight of the fact that housing conditions among the poorer classes have much to do with the prevalence of pulmonary tuberculosis.

Our enquiry into the sex incidence of phthisis leads to this conclusion that as the incidence is roughly speaking almost equal, what is of benefit to one sex is likely to be of benefit to the other.

GEOGRAPHICAL DISTRIBUTION.

Tuberculosis flourishes in every country and in

every climate from the cold of northern Russia to the heat of India and Ceylon. It is however less prevalent where the population is scattered and leads an open-air life; more prevalent in large towns where over-crowding is common.

No climate can be said to be really antagonistic to tuberculosis; high altitudes have been advocated by some, equable climates by others; again, dryness as opposed to humidity was thought to be of prime importance. On the other hand the character of the soil was regarded as a factor of some moment.

Let it be granted that climate per se is not the essential; the real facts as far as climate is concerned may be summed up in the following words:- Pure air and plenty of it discourage the disease; foul air and overcrowding encourage the disease. A few words from the pen of the great Henry McCormac may not be out of place in this connection, he writes:- "There "is in fact no panacea in Californian air, no peculiar "specific for lung troubles. If we cannot have the "summer of California or the winter of sunny Mexico "we possess not the less a climate, whatever some may " say against it, replete with almost every possible "element of vitality and well-being. We have air as "pure as any obtainable on Californian or Mexican hills "air abounding in Oxygen and Ozone, air, in short, "which if we only do not respire it twice, leads to "as perfect security from tubercular disease here as "there. The shores, almost any of them, of our own

"islands, our mountain slopes and airy downs, our
"our many heaths and moors, will often, if not most
"times, prove preferable to, while they are much more
"accessible than, is any Nice, or Rome, or Madeira.
"The materials for the possible recovery from phthisis
"I repeat, lie around every door."

MODES OF INFECTION.

Firstly, let it be clearly understood that because a person is infected with tubercle, that is, has the tubercle bacillus introduced into his body in some way or another, he does not necessarily contract the disease tuberculosis. Therefore, one must really regard this question of infection from two aspects:

1. The introduction of the bacillus to the body, &
2. The action of the body towards the bacillus or vice versâ.

In other words I wish to emphasize the fact that although the bacillus may be inhaled or ingested by many people, it only injuriously affects those whose vitality is below par and whose weakened lungs form a resting and breeding place for this bacillus.

We will consider four modes of infection, altho' the first two are those of main importance.

1. Infection by inhalation through the respiratory tract.
2. Infection by ingestion through the digestive system.
3. The congenital mode of infection.
4. Infection by direct inoculation.

Infection by Inhalation.

This method of invasion of the body by the

tubercle bacillus appears an eminently simple and natural explanation of localised tuberculous processes within the lung. Cornet (1) was an early exponent of the doctrine that inhalation infection took place solely through the conveyance of tubercle bacilli with contaminated dust to the terminal bronchioles and alveoli by means of the respiratory current. The essential element of danger attaching to tuberculous sputum was regarded as attributable to its dryness. Flugge and others however have shown that consumptives in the act of coughing and even of loud talking may disseminate a fine spray containing tubercle bacilli. Koch (2) exposed rabbits, guinea-pigs, rats and mice to an infected spray for half an hour on three successive days, and produced tuberculosis in every animal. Tappeiner (3) in 1877 & 1878 experimented on dogs, making them inhale infected spray for an hour twice a day, and in every case except one, he found miliary tubercles in the lung on post-mortem examination. Heymann found that spray particles from human beings inoculated into guinea-pigs produced tuberculosis. He also found that the length of life of the tubercle bacillus in these droplets was 18 days in the dark and 3 days in the light.

Under ordinary circumstances and absence of draught the zone of danger round a consumptive patient extends to about 3 feet.

Another point of much importance is that the

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(1) Cornet "Die Sterblichkeits verhältnisse in dem Krankenpflggeorden" &"Zeitschrift für Hygiene" Pt.I Vol.VI.
(2) Koch "Die Aetiologie der Tuberculose", (3) Tappeiner "Ueber eine neue Methode Tuberculose Zuerzeugen" Virch. Archiv. 1878 Bd.74 p. 393

bacilli in the moist particles of cough spray are probably of higher virulence than those in dried sputum dust.

Smith (1) in an exhaustive study of cattle tuberculosis whilst averring that the chief mode of infection is by inhalation, yet states that the chief seat of the lesion is in the lymph nodes. He believes the passage of bacilli to the mediastinal glands in cattle to be largely through the tracheal and bronchial mucosa. It is clear that the lungs may become the seat of tuberculous infection by extension from mediastinal glands, but whether or not the tubercle bacilli pass in large numbers through the tracheal and bronchial mucosa to the proximal lymphatic glands must remain for the present sub judice.

Cornet has produced tuberculosis in guinea-pigs by exposing them to dried tuberculous sputum. Moeller reports the finding of bacilli upon the eye-glasses of his assistant, as well as on the head mirror, after an examination of patients with tubercle of the larynx.

Niven (2) found that in 78 common lodging-houses in Manchester the annual deathrate from phthisis was slightly over 20 per thousand .

In these houses much tuberculous sputum is discharged on the floor, and, owing to the movements of the inhabitants, the sputum rapidly dries, and the infective particles are diffused in the air.

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(1) Bonney "Pulmonary Tuberculosis & its complications" Chap. III.
(2) Report on the health of the City of Manchester for the year 1899

The danger in these common lodging-houses is greater on account of the overcrowding.

Villemin (1) resognised the danger of pulverised tuberculous sputum and Delépine (2) proved the enormously important fact that tubercle bacilli can grow at ordinary room temperature both summer and winter.

One is constantly, in public health work, coming across instances of previously healthy persons becoming infected with tuberculosis after going to live in a house previously occupied by a consumptive. Such cases may be said to be of almost daily occurrence, despite the endeavours which are made to disinfect tuberculous houses. In these cases the infection is clearly air-borne, and inhaled, and tubercle bacilli have been found on the floor and walls of rooms occupied by consumptives.

When we consider all these facts, and the weight of evidence which the work of these different authorities brings to bear on the subject, I think it must be granted that infection does undoubtedly occur by inhalation both of moist droplets of infected breath and of dried infected dust. It would appear from the above results that inhalation infection would be frequently met with among doctors and nurses in attendance on phthisical patients, but this as a matter of fact is very rare. Dr. Rufenact Walters, the author of "Sanatoria for Consumptives", states that no member of the staff at Crooksbury Sanatorium has acquired

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(1) Villemin "De la propagation de la phthisie" Gaz. Hebdom: 1896 p. 82.
(2) Delépine "Journal of State Medicine" March 1896 p.82.

phthisis from the Patients, out of 76 servants, 12 housekeepers and 14 nurses.

This has been advanced as an argument against inhalation infection, but, as a matter of fact, it is more an argument in favour of the resistance to tuberculosis of persons leading an open-air life. Again, consider the comparative infrequency of infection of doctors and nurses attending cases of scarlet fever and diphtheria, and yet these are typically infectious diseases. Goodall (1) estimates that in the hospitals of the Metropolitan Asylums Board, for every 100 cases admitted, 0.6 members of the staff acquire scarlet fever and 1.3 acquire diphtheria.

Let me sum up the arguments in favour of the inhalation mode of infection:-

1. The bacilli are found in air-borne dust, especially in rooms inhabited by Consumptives.
2. The prevalence of the pulmonary form of tuberculosis.
3. Tuberculosis attaches itself to particular small localities, houses and even rooms and infects successive occupants.
4. Tuberculosis can be experimentally produced by causing animals to inhale infected matter.

All these points taken together make out a very strong case for the theory of infection by inhalation.

Infection by Ingestion via the Digestive System.

Here we are at once met by an all-important question, namely, the relationship existing between human and bovine tuberculosis. Is the bovine form

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(1) Goodall, E.W. Transactions Epidemiological Soc: 20th April 1900.

transmissible to man, and vice versâ? Are the two bacilli identical or an entirely separate type? Villemin (1865) was the first to maintain that the two bacilli were identical, and Chauveau (1868) confirmed his work. Koch in 1882 also stated that he considered the bacilli identical.

Virchow (1863) was the first to doubt this identity and Baumgarten (1893) shewed that it was impossible to transmit human tuberculosis to cattle. A calf which, he inoculated with human bacilli exhibited no evidence of disease, and when killed after several months, showed no trace of tuberculous change. Another animal, inoculated with bovine tubercle bacilli, died in six weeks, and shewed at post-mortem examination general miliary tuberculosis.

The Royal Commission on Tuberculosis (1895) stated that they regarded the two diseases as identical and transmissible from man to animals and from animals to man.

Greatly to the surprise of the scientific world, Koch in 1901, at the London Congress on Tuberculosis, absolutely changed his point of view on the question, and although challenged by counter-evidence on the part of Mac Fadyean, Ravenel and many others, still maintained his new theory.

Only as recently as last year (1909) he gave a lecture in London in which he stated his belief that the disease tuberculosis in man, and in cattle, is two distinct and separate diseases, and that the bovine

form is not transmissible to man, nor the human form to cattle.

It may be interesting to recount briefly Koch's observations:-

Nineteen young cattle, free from tuberculosis, were subjected to prolonged periods of inhalation exposure, to food infection, and to direct inoculation, by human bacilli. These animals after 6 to 8 months presented no trace of tuberculous lesion at autopsy. The same attempts, with bovine bacilli, were attended with constitutional symptoms within one week, and extensive tuberculous changes were found at autopsy two or three months later. In support of his theory he pointed to the large number of bovine bacilli found in butter, and milk, and to the alleged rarity of primary intestinal tuberculosis in infants.

Only ten cases of primary intestinal tuberculosis in infants were observed during a period of 5 years at the Charité Hospital, Berlin.

In contradistinction to these figures, Carnegie Dickson and Dingwall Fordyce, speaking at the Congress on Tuberculosis held in Edinburgh in 1910, emphasised the comparative frequency of intestinal tubercle met with in children attending the Royal Edinburgh Sick Children's Hospital, and urged the more thorough control of the City's milk supply.

Weber has reported the finding of bovine bacilli in the cervical glands of children. He asserts that this variety is almost exclusively found in the young

and that there is a great tendency to spontaneous cure.

There seems little doubt from the work which has been done that the human and bovine tubercle bacilli are distinct and recognisably distinct, but whether the one is simply a modification of the other or not, is a much more debatable point.

Nathan Raw (1) makes the following assertion:-

"That the enlarged lymphatic glands of the neck, tuberculous peritonitis, tuberculous meningitis, and lupus, are occasioned by the ingestion of bovine bacilli while the origin of pulmonary phthisis is attributed to the introduction of the human bacillus."

The Royal British Commission appointed in 1901 to enquire into this question stated in their interim report (1904) (2) - "There can be no doubt that in a "certain number of cases the tuberculosis occurring "in the human subject, especially in children, is the "direct result of the introduction into the human body "of the bacillus of bovine tuberculosis, and there also "can be no doubt that in the majority at least of these "cases the bacillus is introduced through cow's milk. "Cow's milk containing tubercle bacilli is clearly the "cause of tuberculosis. A very considerable amount "of disease and loss of life, especially among the "young, must be attributed to the consumption of cow's "milk containing tubercle bacilli. The presence of "tubercle bacilli in cow's milk can be detected though "with some difficulty, if the proper means be adopted

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(1). Bonney "Pulmonary Tuberculosis & its Complications" Chap. III

(2). Interim Report (1904) of Royal Commission on Tuberculosis 1901.

"and such milk ought never to be used as food. There "is far less difficulty in recognising clinically "that a cow is suffering from tuberculosis, in which "case she may yield tuberculous milk. The milk "coming from such a cow ought not to form part of "human food and indeed ought not to be used as food at "all."

These results are directly in accord with those published by Drs, Schroeder & Cotton in the Bulletin of the Bureau of Animal Industry of the United States. They even affirm that a tuberculous cow constitutes an element of much greater danger to the health of the community than a human consumptive.

Mayo has called attention to the relative infrequency of pulmonary tuberculosis in an agricultural community, although all forms of surgical infections abound, and ascribed the prevalence of the latter varieties to the ingestion of the bovine bacilli contained in uncooked milk.

During a personal examination of over 800 sputa of human consumptives I have on several occasions come across bacilli corresponding to the bovine type as described by Ravenal and Theobald Smith. They are short, fat, non-curving rods, as contrasted with the slender and curved form of the human bacillus. The length of the bovine bacillus is about twice its breadth, while that of the human bacillus may be ten or twenty times. The bovine bacillus does not show such a marked capsule.

When examining the patients in whom these bacilli of the bovine type have been detected, I have without exception found marked evidence of disease, generally well in the substance of the lung, either at the base of the upper lobe or in the lower lobe. I have never found these bacilli in a patient exhibiting early apical lesions. Patients with the bovine type of bacillus seldom, in my experience, make a satisfactory recovery, and the presence of this type of bacillus is of bad prognosis.

The questions arise: are such cases affected via the alimentary tract, and do the bacilli pass upwards to the bronchial lymphatics and thence to the lung tissue? Are such cases distinct from the apical case exhibiting typically human bacilli? For the present these questions are unanswerable, but they offer a large field for reflection and work. Such cases, I may add, are very rare. I have only come across 4 out of over 800 sputum examinations.

The question still remains: Is it certain that infection whether by human or bovine tubercle bacilli can take place via the digestive system?

It is now known that tubercle bacilli pass readily through the intact intestinal mucous membrane. Numerous workers have found tubercle bacilli in the intestinal glands of children dead from tuberculosis. The fact that children suffer particularly from intestinal tuberclé lends colour to this theory, particularly as, according to Sherman (1), the second year of

(1) Sherman J. Speech at Edinburgh Congress on Tuberculosis 1910.

life is that most particularly affected by tubercle and that is the year when Cow's milk is the chief food of the child.

Calmette and Guerin fed animals with tuberculous material through an oesophageal tube, and were able, by successive experiments, to trace the tubercle bacilli through the mesenteric glands, mediastinal glands, thoracic duct, pulmonary artery and thence to the lung. These experiments seem to form valuable and almost conclusive proof that infection may take place through the alimentary system. It is recognised, of course, that infection takes place through other channels, but an analysis of clinical, pathological and experimental data affords positive evidence of the alimentary mode of entry.

In order that we may have some more or less clear idea of what we have to contend with in this matter, I may lay down the three following statements as worthy of serious consideration by all public health officials:-

1. That infection from a human source is the main source of infection in human tuberculosis.

2. That food stuffs infected with human bacilli can convey the infection.

3. That undoubtedly food stuffs infected with bovine tubercle bacilli can give rise to the disease tuberculosis in human subjects.

In respect of this last statement the observations of Fibiger and Jensen are of great interest. Out of

seven cases of intestinal tubercle in children, five proved to be of bovine origin, as shown by the virulent results of inoculation into calves & rabbits.

In regard to a matter which is in dispute amongst the highest authorities, and the greatest workers, on the subject, it would be absurd and futile to lay down any hard and fast statements. One can only carefully consider the various phases of the work, and reasoning from them, form a working hypothesis upon which to base one's mode of procedure as an official concerned with the welfare of the public health.

The Congenital Mode of Infection.

This method of infection merits some careful thought and has been the subject of much variety of opinion.

When we look at the subject in detail it is quite clear that if we are to believe the theory of congenital infection we must be prepared to grant one of the following postulates:-

1. That the tubercle bacillus is present in the semen, and not only in the semen but in the nuclear material of the spermatozoon and in that particular portion with which the ovum is fertilized,

or

2. That the tubercle bacillus exists in the ovum.

or

3. That the tubercle bacillus is present in the

blood of the mother and thence is transferred through the placenta to the circulation of the foetus.

Baumgarten and his followers believe strongly in the theory relating to direct transmission of the bacilli in utero, and certainly their arguments are to some extent justifiable. We can dismiss the theory of infection via the spermatozoon as practically impossible, although Friedman by injecting an emulsion of tubercle bacilli into the vaginae of rabbits quickly following coitus, found tubercle bacilli in the foetal organs after six days. It must be noted, however, that the tubercle bacilli although present along with the spermatozoa, were not in the spermatozoa, and this experiment hardly simulates the normal sufficiently to be of value.

There remain the two methods of infection via the mother.

Baumgarten after artificial fecundation of the ovum of a rabbit with infected semen, was able to demonstrate tubercle bacilli in the ovum. Apart from this, I can find no evidence that tubercle bacilli have been found in an ovum and the likelihood of this method of infection is small.

This leaves us with the theory of infection via the placenta and the blood. Here we are on more certain ground, although it must always be borne in mind that infants born of mothers in advanced phthisis are subjected to exceptional opportunities for infection shortly after birth.

Well-defined tuberculous lesions have been reported in the placenta of mothers who were in the last stages of consumption.

There can be little doubt that in cases of very advanced tuberculosis, either of lungs or other organs, tubercle bacilli may appear in the blood stream, and it is quite feasible that they may find their way through the fine structure of the placenta into the foetal circulation.

Certain recent writers have maintained that tubercle bacilli occur in the blood stream in all cases of phthisis however early. As this is a matter of extreme importance in regard to congenital infection and as I have personally worked on the subject I shall endeavour to deal with it in some detail.

Rosenberger was perhaps the first to re-open this subject. In his first Report (1) he published the results of the examination of the blood of 50 cases of phthisis in various stages of the disease. In every case examined he found tubercle bacilli with ease. In a later paper (2) he states that he has demonstrated the bacillus in 312 out of 312 cases examined. On examining his work one finds that he based his first results solely upon the result of a microscopic examination of stained preparations. In two cases only did he inoculate animals.

In his second series of cases fifty were controlled by animal inoculation. He thus reports the

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(1) Rosenberger American Journal of Medical Science Feb: 1909, cxxxvii, 2, 267

(2) Rosenberger. New York Medical Journal Ju.19/09.

results:-! "One of the animals died in a month with "miliary tuberculosis of both lungs. Three other "pigs died in two months, one of these presenting "miliary tuberculosis of both lungs and spleen, and "another dying of a frank pneumonia developing upon "a tuberculous condition in the upper lobe of the "right lung. Four pigs showed a few scattered "tubercles in the lung as well as in the liver. The "remainder of the animals (thirty) did not present any "gross lesions, but the blood of each pig contained "acid-fast bacilli resembling those found in human "blood..... I sacrificed a number of animals "at the end of two months and though the bronchial "glands were apparently enlarged, no other changes "were noticed macroscopically."

Forsyth (1) following Rosenberger's technique found tubercle bacilli in the blood of ten cases out of twelve examined. One of his negative cases was probably non-tuberculous.

Petty & Mendenhall (2) found bacilli in 9 out of 10 cases. Foster (3) reported the finding of bacilli in 14 out of 29 individuals; in one of the cases the patient was suffering from secondary syphilis and no evidence of tubercle could be found.

It is unfortunate that all the above reports were based on the findings of microscopical results alone, and were not confirmed by cultures or animal inoculations.

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(1). Forsyth. British Med. Journal April 24th 1909
(2) Petty & Mendenhall Journal A.M.A. Sept.11th 1909
(3) Foster. The Military Surgeon Feb. 1910, 193.

Let us look at some opposite results which have been obtained. Brem(1) suggested the possibility that the acid-fast bacilli originated in the distilled water employed. His explanations have been confirmed by Burville-Holmes (2).

Bernstein & Fried (3) examined the blood of 10 tuberculous patients without finding acid-fast bacilli, while the corresponding guinea-pigs failed to develope infection. Dailey(4) reports negative microscopic and inoculation results in fifteen cases. In a series of 56 cases carried out by Burville-Holmes(5) acid-fast bacilli were only found in 5 instances and of these 3 were from non-tuberculous subjects. It is of great importance to note that of his five positive findings, four were from cases in the Bryn Mawr Hospital where many acid-fast bacilli were later demonstrated in the distilled water, while the 49 negative cases all occurred at the Phipps Institute where the water was found to contain no acid-fast organisms.

Schroeder & Cotton (6) have tested the blood of 42 cattle, in all stages of tuberculosis, by intra-abdominal injection into guinea-pigs, with negative results in every case, from which these observers conclude that: "Tuberculosis is not to be classified, in any sense of the word, as a bacteriaemia."

I shall now give the details of my own researches

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(1). Brem. Journal A.M.A. Sept. 18th 1909
(2) Burville-Holmes N.Y.Med. Journal April 9th 1910, 737
(3) Bernstein & Fried N.Y.MED.Jour: May 29th 1909
(4) Dailey Boston Med: & Surg: Journ. Sept. 2nd 1909
(5) Burville-Holmes, American Journal of Med. Science Jan. 1910
(6) Schroeder & Cotton, United States Bureau of Animal Industry.Bulletin 116 18/8/09.

into this subject. I adopted the method recommended by Rosenberger and followed his details as far as possible in an honest endeavour to substantiate or refute his claims to my own satisfaction.

The method was shortly as follows:- 5 c.cm of blood were withdrawn from a vein in the arm of the patient, by means of a sterile syringe, previously boiled in a solution of caustic soda. The blood was at once mixed with an equal quantity of a 2 per cent solution of sodium citrate in normal saline, well shaken to avoid clot formation, and then allowed to stand in a refrigerator for 24 hours. With a sterile pipette a small quantity of the precipitate was then removed, and made into a thick film on a clean glass slide, dried on a copper plate at moderate heat, laked in sterile distilled water, and finally stained for tubercle bacilli. Care must of course be taken throughout the processes to avoid contamination. Rosenberger did not describe his method of staining in detail. I adopted the usual method used for sputum. Slides were first stained with hot carbol fuchsin for five minutes, then decolourised in 5 per cent sulphuric acid and finally counter-stained with a watery solution of methylene blue.

I examined the blood from twelve cases and did thirteen examinations, as the blood of one patient was examined twice. The results are tabulated over:-

Name.	Age.	Disease.	Duration	Sputum	Result.
M.J.	24	Consolidation both apices	5 years	T.B.-	Negative.
E.F.	23	Cavity both apices	2 years	T.B.+++	"
R.G.(1)	24	Consolidation both apices	3 mos.	T.B.+	Positive.
R.G.(2)	24	" "	"	"	Negative.
F.G	25	do. do.	1 year	T.B.++	"
A.B.	28	" " also tubercle of bones and glands	3½ "	T.B.+	"
T.T.	22	Two cavities left lung, Consolidation right apex.	16 mos.	T.B.+++	"
D.F.	27	Colsolidation both apices	1 year	T.B.+	"
B.C.	23	" "	2 years	T.B.+	"
Mrs. P.	33	" "	18 months	T.B.+	"
J.F.	53	" "	14 "	T.B.+	"
A.M.	29	" " also tubercle of larynx	18 "	T.B.++	"
Mrs. C.	31	Two cavities left lung. Cavity right apex.	4 years	T.B.+	"

Analysis of these results shows that in one instance only, out of 13 examinations, was it possible to demonstrate tubercle bacilli. In this case two acid-fast bacilli were found resembling morphologically the tubercle bacillus. A second examination of the blood of the same patient proved negative after prolonged search, so that I came to the conclusion that the presence of these two bacilli may have been due to some accidental contamination, as I was working in a laboratory where dozens of sputa were examined daily. I was unable to find any traces of acid-fast bacilli in the water which I used.

After carefully weighing up all the evidence that I have been able to find on this subject, and

taking my own work into consideration, I feel that the statement that tuberculosis is a bacteriaemia is at least not proven. My opinion is that, although doubtless in very advanced tuberculosis, tubercle bacilli may find their way into the blood stream, it is a very rare exception, and for practical purposes may be almost disregarded.

Should the bacteriaemic theory be correct, it would lend immense support to the argument in favour of congenital infection.

Huegenin (1) found tubercle bacilli in blood from the heart of a prematurely dead foetus of a tuberculous mother. He was unable to find tubercle bacilli in the placenta or in any other part of the foetus.

Bossi believes that the tubercle bacilli themselves do not enter the foetal circulation, but that their toxins do, and that these toxins being absorbed by the foetus give rise to the well-known inherited weakness and lack of resistance in the offspring of tuberculous parents.

The frequency of the disease tuberculosis at an early age, and its high mortality in the first few years of life, seem to lend colour to this source of infection, but it is important to put against this the fact that infants are remarkably susceptible to tuberculous infection, especially via the alimentary canal, and also that the tubercular trouble does not usually assert itself until a year or two at earliest after birth. Was the infection acquired in utero, we should expect

(1) Huegenin, B, Zeitschrift für Tuberkulose, Ap: 1909.

the disease to arise soon after birth,

Again, the facts that during the first few years the child's food is mainly milk, and that, if born of tuberculous parents, it will probably be subjected to direct infection after birth, afford other possible sources of error in statistics on this subject.

It cannot be over-looked that whether or not there is actual congenital infection, there is without doubt an inherited tendency towards the acquisition of tuberculosis among children of tuberculous parentage.

Williams recorded a family taint in 48.4% of 1000 cases of consumption, whereas Solly reported a family history of tubercle in 28.8% of cases investigated.

I will conclude this subject by quoting the words of the late Professor Hamilton of Aberdeen who held predisposition to be a true inherited strain and wrote as follows (1):- "Where has the inherited "strain come from? What is its ancestral history? "Can it be generated by vicious surroundings? I "question whether it can. No doubt, once in the "blood, the particular habit may be fostered by every "external agent which tends to deteriorate the natur-- "al powers of resistance. But will such external "agencies tend to produce a particular colour of hair, "a certain narrowness of chest, tallness of stature, "and other peculiarities which are distinctive of "the tuberculous constitution? My conviction is that "they will not, and that we must go much further back

(1) Hamilton, D.J. Scottish Med: & Surgical Journal Vol.1V, p.289.

"in the history of the human race to get at the explan-
"ation of the matter. My own impression is that these
"features are the lineal descendants of a variation
"which took place far back in our history, that the
"variation has occurred irrespective of surroundings
"or external agencies, and that its influence has been
"propagated in the descendants ever since. It may
"be a variation which is common to many races, but
"one which is intensely hereditary."

Sutherland (1) writes that: "accepting this
"origin of predisposition, I would further suggest that
"tuberculosis in the parents favours a throw-back in
"the offspring along an old inherited strain."

To sum up this matter, it may be said for practical purposes that congenital tuberculosis although an admitted possibility must be regarded as of rare occurrence. An inherited pre-disposition in certain persons to the disease tuberculosis is an acknowledged fact and one of much practical importance.

Infection by Direct Inoculation.

Although this may occur, I do not consider it of sufficient importance to be considered in a paper dealing essentially with the public health aspect of tuberculosis.

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(1) Sutherland, H.G. Edinburgh Medical Journal, June 1909.

METHODS OF PREVENTION.

From what has already been considered, it will be clear that the main points which must receive attention in any scheme of prevention are as follows:-

1. The eradication of means of infection via the food. This means the thorough regulation and control of meat and milk supplies.

2. The prevention of infection from one affected human being to another non-affected.

3. The education of the people as to healthy modes of living especially as to the evils arising from over-crowding.

4. The careful supervision of school children and the early detection of cases of phthisis among them.

5. The efficient ventilation of schools, theatres, churches, factories and all other places where numerous people are brought into contact with each other.

These several points will now be treated more in detail:-

MILK SUPPLY.

It was admitted earlier in this paper that milk might quite reasonably be looked upon as a source of infection. What steps then shall be taken in order to obviate this in so far as possible?

The requirement is a pure milk supply or in other words a clean, whole milk, unadulterated; firstly, derived from healthy cows, guaranteed free from tuberculosis by the tuberculin test and living under clean and sanitary conditions; Secondly, obtained by clean methods of milking, strained and protected from contamination and from infection; thirdly, kept cool by

means of refrigeration: and fourthly, not exposed to dust or uncleanliness in any way from the vessel in which it is placed or from the persons by whom it is handled.

In order to obtain these desiderata it will be well to consider in detail the various steps by which the milk is obtained from the cow and removed to the consumer.

The three main points of infection are:

1. From tuberculosis in the cow herself.
2. From tuberculosis in milker or dairyman.
3. From contamination of the milk from dirt or dust during transit from cow to consumer.

The various means of preventing these infections which I here advocate, are based roughly on the code of rules in operation in parts of Germany and known as the "Bonn Rules", modified in some ways by my own experience. (1)

Care of the Cow -- General Rules.

The milk of any cow which reacts positively to the tuberculin test should not be used for food.

All Cattle suffering from Tuberculosis should be kept apart from healthy cattle.

Cows should not be placed head to head facing a common feeding trough.

The drinking water supplied to cattle should meet essentially the same requirements as are demanded of water supplied to dwellings.

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(1) von Behring "The Suppression of Tuberculosis", p.60.

REQUIREMENTS OF THE STABLE.

It should be built so that it can be readily and easily cleansed.

The fluid excreta should be drained away by means of drains with sufficient pitch.

Solid refuse should be regularly removed without creating dust.

A plentiful supply of hot and cold water should be at hand.

Each stall should be constructed in such a manner that the cow is obliged after feeding to step back thus compelling her to empty her excreta into an open drain. This is effected by means of the so-called 'drop-railing contrivance'. The flooring should be water-tight.

All stables found to be infected with tuberculosis should be disinfected. Hot 2% soda solution is a most efficacious mode of dealing with the surfaces of a tuberculously infected stable.

CLEANLINESS OF THE MILKER.

General bodily cleanliness and especially absolute cleanliness of the hands is an essential. Also the hands should be in a healthy state.

It is preferable that the milker should wear a clean white linen gown.

No person suffering from tuberculosis should be allowed to milk cows.

PREPARATION OF THE COW FOR MILKING.

The udder and tail must be thoroughly cleansed. A good method is as follows:- "The udder which should "always be kept dry, is to be rubbed with a clean "flannel cloth which has been greased with a little "lard. By this means dirt and odourous substances "are most easily removed. Following this, the parts "are rubbed dry with a little bran."

If all these precautions be followed there is little fear of getting a contaminated milk and still less fear of getting a milk containing tubercle bacilli.

THE LAW REGARDING MILK WITH REFERENCE TO TUBERCULOSIS.

The Dairies, Cowsheds and Milkshops Order of 1885, sec: 15, states that: The milk of a cow suffering from cattle plague, pleuro-pneumonia, anthrax or foot and mouth disease, (a) shall not be mixed with other food; (b) shall not be sold or used for human food; and, (c) shall not be sold or used for food of animals, unless it has been boiled.

The Dairies, Cowsheds & Milkshops Order of 1899 however amended the above sec: 15, so as to include Tuberculosis of the Udder, as one of the diseases concerned.

Regarding the general control and regulation of Cowsheds and Milkshops whereby supervision by the Medical Officer of Health is assured and certain rules laid down as essential, I do not intend to quote

sections of the order. Suffice it to say that sections 6 to 14 practically cover all the essential points. Control is through them exercised over lighting, ventilation, air-space, drainage, water-supply of the cowshed; over the health and cleanliness of the milker; and over the cleanliness and sanitary condition of the vessels and dairy. The Local Government Board has issued Model Regulations under section 13 of the Dairies, Cowsheds and Milkshops Order, which practically lay down similar rules to the "Bonn Rules" quoted earlier, and which are largely followed in most well-organised sanitary areas.

In many towns there is a systematic examination of samples of milk for tubercle bacilli. If they are found however it is impossible to seize the milk as it will already have been consumed, but it draws the attention of the sanitary authority to a particular dairy, and if the cows supplying this dairy be specially examined, and if a cow suffering from tuberculosis of the udder be discovered, then the law may be brought into force to prevent the milk from that cow being used as food.

It is unfortunate that at present we have no law which prevents the use of milk from a cow suffering from tuberculosis other than that of the udder, or from a cow which reacts positively to the Tuberculin test. It is hoped however that before long powers will be given to sanitary authorities to control this source of danger.

Where milk has to be supplied to children and it

is impossible to guarantee it as free from tubercle bacilli, one of the following methods should be adopted:

1. Sterilisation This means the use of heat at or above boiling point. This may be applied in one spell of one or two hours at 212° to 250°F. or at stated intervals at a lower temperature.

2. Pasteurisation - The bacteria causing the diseases conveyable by milk succumb at much lower temperatures than boiling point. Hence the process of Pasteurisation, in which milk is heated to between 167° & 185°F., has been much adopted.

When milk is sterilised it contains no living germs, is altered in chemical composition, and possesses a flavour which to many people is unpalatable. The process of Pasteurisation kills bacteria, but does not physically change the milk and for that reason it has been much adopted by corporations, dairy companies, hospitals, etc.

The control of the milk supply is a matter which should receive careful attention from all sanitary authorities, not only as a preventive of tuberculosis but as an important influence on the general health of the Community.

MEAT SUPPLY

Tuberculosis is a disease very frequently met with in Cattle. Though it is so common in bovine animals, it is also a very frequent condition in swine, while it is a comparatively rare thing to encounter it in either sheep or horses. Other things being equal, tuberculosis is found to be most common amongst cattle herded closely together, and under conditions in which they are ill fed, and kept in byres where free and adequate ventilation is not provided. On the other hand where the animals live an open-air life all the year round, tuberculosis is very seldom met with.

Probably from 20 to 30 per cent of cattle in Great Britain are affected to a slighter or greater degree with this disease. For swine the percentage is probably from 4 to 5.
Tuberculosis in the case of sheep and goats occurs in only about .002 per cent of the animals (1).

As regards the organs attacked in bovine tuberculosis, the lungs are the most frequent, after which come the serous membranes and lymphatics, and in many cases we see a generalised tuberculosis.

Rieck in 430 cases of general tuberculosis in cattle, identified at the abattoir in Leipsig in 1880-1891, found the following sequence in the affection of different organs:-

Lungs	100%	Meat	49.3%
Liver	83%	Spleen	18.6%
Alimentary Canal	73%	Udder	16.7%
Serous Membranes	57.4%	Bones	8.8%
Kidney	52.5%		

(1) Leighton & Douglas "The Meat Industry" Vol III p.857.

If we examine these figures, it will be seen that the two parts of a carcase most intimately concerned with human food, namely Meat and Bones, come very low down on the list. It must be acknowledged that although meat is undoubtedly a potential source of infection in human tuberculosis, it is a decidedly remote risk.

I do not consider that Meat is by any means an important source of tuberculous infection, but that is no reason why our inspectorial methods should be in any way relaxed, as a carcase infected with tuberculosis is generally unfit for human food on account of its poor nourishing and health giving properties; also, apart from this one does not like to eat tubercle bacilli if it can be prevented, and there is always the risk of surface contamination of the meat from a butcher's knife which has also been used to cut the affected offal or serous membranes.

Dr. Arthur Littlejohn (1) thus sums up the matter: "From the foregoing we may conclude that the flesh of "tuberculous animals is not necessarily infectious. "In many, if not the majority of cases when the flesh "is infectious, this is the result of contamination "by means of the knife, butcher's cloth, etc. This "occurs during the dressing of the carcase, from "either the carcase itself or one previously dressed".

The last three words show clearly that the risk may be quite as great from eating the flesh of a non-tuberculous animal as that of one affected with

(1) Arthur R.Littlejohn Paper read before the National Tuberculosis Conference in London (Published in "The Practitioner")

Tuberculosis. At the same time it should be our endeavour to keep all tubercular animals out of our slaughter-houses.

If this is to be effectually done however, it would entail great expenditure. It would mean the testing of all animals with tuberculin and the exclusion of all animals found positive. This again would probably necessitate the compensation of the owners of the affected animals. At present I am one of those who hardly consider that the time has come for such drastic procedure with regard to meat, although where milk-giving cows are concerned the tuberculin test ought to be stringently enforced.

It may be well to glande at the Law as it affects tuberculous carcases.

By Section 116 of the Public Health Act 1875, any Medical Officer of Health or Inspector of Nuisances may at all reasonable times inspect any animal, carcase, meat, poultry, game, fish, flesh, fruit, vegetables, corn, bread, flour, or milk exposed for sale or of preparation for sale, and intended for the food of man.

Power to seize and lay before a justice is given to the Medical Officer of Health or Inspector of Nuisances if the animal etc. appears to be diseased, unsound, or unwholesome, or unfit for the food of man.

This is amplified by sections 117, 118, & 119 of the same act. The Public Health Act (Amendment) Act 1890 section 28, modifies sections 116 to 119

of the previous Act so as to apply to all articles intended for the food of man, sold, as well as exposed for sale.

The question now arises as to what may reasonably be considered unfit for the food of man in the case of an animal more or less infected with Tuberculosis.

Most sanitary authorities now rely, with modifications, upon the recommendations of the Royal Commission on Tuberculosis 1898, which are briefly as follows:-

I. The entire carcase and all the organs may be seized:-

(a) When there is miliary tuberculosis of both lungs.

(b) When tuberculous lesions are present in the pleura and peritoneum.

(c) When tuberculous lesions are present in the muscular system or in the lymphatic glands embedded in or between the muscles, and

(d) When tuberculous lesions exist in any part of an emaciated carcase.

II. The carcase if otherwise healthy shall not be condemned but every part of it containing tuberculous lesions shall be seized:

(a) When the lesions are confined to the lungs and thoracic lymphatic glands

(b) When the lesions are confined to the liver

(c) When the lesions are confined to the pharyngeal lymphatic glands.

(d) When the lesions are confined to any combination of the foregoing but are collectively small in extent.

III. In the case of the pig, if tubercular deposits be present in any degree, the whole carcase and organs should be seized. Foreign dead meat

with 'stripped' pleura should be seized.

It is thus clear that one has a considerable control over tuberculous carcases once they are in the slaughter house, if meat inspection be thoroughly and systematically carried out. As I pointed out earlier however, it should be our endeavpur to prevent tubercular animals from reaching our slaughter-houses. The Tuberculosis in Animals Regulations which should have come into force on January 1st. 1910 but which were unaccountably withdrawn, will help considerably towards this end. It is to be hoped that the Government may see their way clear to put these regulations into force at an early date.

VENTILATION AND AIR-SPACE.

This opens up a large field which however, although by no means minimising its importance, I only intend to deal with briefly in this paper. I do not wish to open the huge question of the housing of the working-classes, and the work which falls to be done by the Medical Officer of Health under the Housing and Town Planning Act. I shall confine myself here to what may be done to obtain sufficient air-space in places where persons meet together either for work, pleasure or worship.

Churches and Theatres are notoriously the worst offenders in this respect and presumably because persons are only congregated in these places for a short time, legislature has practically neglected them in so far as air-space and ventilation are concerned.

Turning however to factories and board schools, we are met with a much more hopeful outlook.

Kerr suggests as regards schools a limit of 16 to parts of CO_2 per 10,000. About 2000 cubic feet of fresh air per head per hour is required and it should enter the room at a rate not exceeding 5 feet per second. As natural ventilation is rarely sufficient to maintain this purity, artificial means is therefore desirable though not always attainable in practice.

Into the pros and cons of the different means of ventilation I do not intend to enter, but it certainly must be borne in mind that efficient ventilation of school-rooms where children of an age susceptible to phthisis are brought into close personal contact should be a most important part of our anti-tuberculous campaign.

As regards air-space, the Board of Education prescribe not less than 120-200 cubic.ft. of air-space per pupil and 10 sq. ft of floor space, except in the case of infants where 9 sq. ft. is sufficient.

Turning to Factories and Workshops much still remains to be done and it is an every-day occurrence to enter a large factory and find every window closed and the atmosphere most offensive. It is difficult to prevent this, as although the ventilation may be defective, yet the air-space per worker may be within the legal limit.

According to the Factory & Workshops Act 1901 Section 3, the following must be observed:

"Factories, workshops and work-places must not

"be so over-crowded as to be dangerous or injurious "to the health of the workers and there must be at "least 250 cubic feet of air-space for each worker. "The air-space of each work-room must be stated in "a notice affixed in the works."

General ventilation must be efficient in every work-room of a factory or workshop and any standard fixed by the Secretary of State must be observed.

As will be obvious from what has been said, it is only by a thorough and genuine system of inspection by Government Inspectors of both schools and factories that the persons concerned can be made to keep the law. Where the Secretary of State has fixed a standard, samples of air should be taken during a chance visit and submitted to examination. Some persons are afraid of ventilation in any shape or form and it is only the fear of the visit of an inspector, and a possible subsequent prosecution, which will induce them to keep within the legal standard.

As regards ventilation in private houses, except in so far as the building of the house is concerned, nothing can be done, more's the pity! The saying that "An Englishman's house is his Castle" has always to be borne in mind, and it is only by making people see for themselves the benefit to health which comes from plenty of fresh air that we can hope to touch the large question of efficient ventilation.

A CO-ORDINATED SCHEME TO MINIMISE THE RISK OF INFECTION FROM PERSON TO PERSON.

The Scheme with which I here intend to deal is now generally known as the "Edinburgh System". In 1887 Dr. R. W. Philip instituted the Victoria Dispensary for Tuberculosis in Edinburgh and he has by unremitting and thoughtful work gradually woven around this central stem the whole fabric of the Edinburgh Scheme.

The Edinburgh scheme consists essentially of the following factors:- (1)

I. Dispensary
II. Sanatorium
III. Hospital for Advanced Cases.
IV. Working Colony.
V. Notification of the Disease.
VI. Disinfection of infected houses.

In appreciation of this scheme I may say that it is almost generally acknowledged throughout both England and America as being the plan par excellence for dealing with this difficult question. It has been adopted by the Local Government Boards both of England(2) and Scotland (3) and is recommended to local Authorities as the ideal to be aimed at.

This scheme embraces all aspects of the problem in the most thorough manner, and although a great weapon against Tuberculosis in the hands of the Public Health Authorities, it has been found in practice in no manner to interfere with or be detrimental to the

(1) R.W.Philip. "The Rôle of the Consumption Dispensary in the Tuberculosis Campaign" p. 17. Ap. 21st. 1909.
(2) Mem. of Med. Off. of the L.G.B. on Administrative Measures against Tuberculosis. Feb. 1909
(3) Administrative Control of Pulmon. Phthisis L.G.B.Edin. 10/3/06.

General Practitioner.

As I have had personal experience of every branch of this scheme, both hospital and administrative, I intend to deal with it in a thorough manner and to emphasize both the advantages and disadvantages especially from the point of view of a health official.

Granted that a municipality is prepared to undertake this scheme, it is obvious that it must be urged upon it by the medical officer of health. This being the case, let us first consider how he is placed in the scheme.

When the whole system is thoroughly understood it will be apparent that the Medical Officer of Health is or should be the moving spirit and moreover the governing personality of the whole system.

Just as at present the Medical Officer of Health is in most towns Medical Superintendent of the Fever Hospital and of the Sanatorium where such exists, so should he be Medical Superintendent of the Tuberculosis Dispensary. One does not mean by this that he should personally examine and treat the patients, but that he should have supreme control over the Dispensary, the routine work of which will be carried out by an Assistant. One is not here advancing any radically new idea, but merely an extension of what exists at present in most towns with reference to the

Fever Hospital and other branches of the Medical Officer of Health's work.

In most towns we find the Medical Officer of Health is also School Medical Officer and Medical Superintendent of the Fever Hospital, but it is realised that it is quite impracticable for him to adequately perform the routine work of these offices, he therefore has one or more Assistant Medical Officers who are responsible for the Medical inspection of School Children and for the management of the municipal fever hospital. It is not going very far to suggest that in towns of suitable size an Assistant Medical Officer should be appointed whose primary duty would be to attend to the Tuberculosis Dispensary, and to keep under his eye all cases of Tuberculosis in the town. This assistant need not necessarily hold a Public Health qualification but he must have had experience in Tuberculosis. The City of Liverpool in 1910 appointed such an official.

It has been suggested that the Medical Officer to the Tuberculosis Dispensary should be quite apart from the Medical Officer of Health's Department. This of course is the case in Edinburgh and in the Paddington Dispensary, London, but then it must be borne in mind that these are charitable institutions and not controlled financially or otherwise by their local authority. It has been found in practice that it is much the most satisfactory thing to have the Medical Officer of Health also the School Medical Officer and in many cases where this is not the case,

there is apt to be friction and unpleasantness between the two departments, and neither is seen to the best advantage as far as the children and infectious disease are concerned. Were the Medical Officer to a Municipal Tuberculosis Dispensary to be entirely independent of the authority of the Medical Officer of Health, it would be found in most cases that the maximum benefit would not accrue from the Dispensary.

If we consider how intimately the Edinburgh system is bound up with the Department of the Medical Officer of Health it will be clear that his must be the controlling hand over Sanatorium, Hospital for advanced Cases, and Dispensary. Considering a case of Tuberculosis of the Lungs from the beginning, under the Edinburgh system. First, the case is notified to the Medical Officer of Health; he, unless the notifying medical man wishes otherwise, then communicates with the Dispensary Nurse, and she visits the patient and advises him as regards treatment and prevention of infection. The question then arises, is the patient suitable for the Municipal Sanatorium, or is he so far advanced as to be a proper subject for the Hospital for Advanced Cases? In order to decide this, the Medical Officer of Health will request the patient to present himself at the Dispensary for examination, or if too ill, the Medical Officer to the Dispensary will visit and examine him at his home. If he is removed either to Sanatorium or Hospital for Advanced Cases, the Medical Officer of Health then undertakes disinfection of his house and clothing. Should the

case be treated at home, the Medical Officer of Health through the Dispensary, keeps a constant watch over the patient's habits and surroundings, so as to minimise the risk to other members of his household.

Thus we see that two phases at least in this disease history are, even apart from the Edinburgh system, confined essentially to the Medical Officer of Health, namely Notification and Disinfection, and in addition, in some places where a Municipal Sanatorium exists, the Medical Officer of Health personally examines all candidates for admission. It would be folly under these circumstances to try to divorce the Tuberculosis Dispensary from the Department of the Medical Officer of Health. If this were done, the Medical Officer of Health would have no control over the Dispensary Nurse, or Medical man, and constant duplication of work, ineffectual dealing with the patient, and possibly even the expression of contrary opinions would occur.

It is acknowledged that the prevention of Tuberculosis comprises many other points besides the mere treatment of the patient. Thus, overcrowding, bad ventilation e.g., back to back houses, bad sanitation and general uncleanliness, unhealthy cows, and insanitary byres must also be given attention. To quote a Local Government Board Circular on this subject (1) "Direct prevention must go hand in hand with general "sanitation." Under these circumstances is it not obvious that the Medical Officer of Health who has

(1) Administrative Control of Pulmonary Phthisis. L.G.B. Edinburgh (Public Health No.1 1906)

control of the "general sanitation" of the town should also be the governing spirit in the "direct" measures.

Clearly the Medical Officer of Health through the agency of the Dispensary plays the central part in the Edinburgh system and it is quite impossible to get the maximum benefit without making him the chief administrator in all the various parts of the scheme.

Let us now consider each portion of this system in detail.

NOTIFICATION OF PHTHISIS.

There are two means of notification of phthisis now in use in this country, namely, voluntary and compulsory, excluding the Public Health Tuberculosis Regulations 1908, which only deal with the pauper section of the public. The former is employed in many towns in England, but the latter only in Sheffield Bolton, Burnley and Oldham.

It will be obvious that if one is to deal in any way effectually with Phthisis, it is absolutely essential that some means be employed to enable the authorities to estimate how many cases of the disease exist in their locality, and also in order that they may be able to locate the disease, warn the patient of the infectious nature of his complaint, and carry out some method of disinfection of the house or room before allowing any other person to occupy it.

Notification as applied to other infectious diseases has been in use in England and Scotland since the passing of the Infectious Diseases Notification

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Act 1889. This was an adoptive Act, but was made compulsory on all local authorities in England and Wales by the Infectious Diseases Notification Extension Act 1899, and in Scotland by the Public Health (Scotland) Act 1897 (sec. 44). It will be seen at once however that in dealing with Pulmonary Tuberculosis we are dealing with a disease differing essentially from those diseases included in the above Acts such as Scarlet Fever, Diphtheria, Erysipelas etc. To begin with, it is much more chronic in type, it is as a rule much more frequently unrecognised and in addition there are many people who strongly object to being, as they call it, "branded" with the stigma of tuberculosis.

That pulmonary Tuberculosis is highly infectious has been proved elsewhere, but here we may merely content ourselves with emphasising most strongly that this disease is infectious in the highest degree. It has now been abundantly proved that it is due to a specific organism, the tubercle bacillus, and that this bacillus may be transferred from a patient to a healthy person by means of the breath, the cough, the sputum, and most particularly from a Public Health aspect by being harboured in infected houses and finding lodgment in the lungs of a later inhabitant.

If notification be employed in cases of Scarlet Fever which as a rule run their infectious course in seven to eight weeks, how much more necessary is it in the case of a disease where the patient may remain

uncured and infectious for many years, and capable of infecting all those persons with whom he is brought into intimate contact.

Let it be said at once that the mere notification of cases of Phthisis can do no material good, unless it be combined with measures for the prevention of the spread of infection. The danger of the infection of other people is undoubtedly greatest amongst the poorer classes, for two very good reasons; firstly, they are as a rule slow to seek medical advice, and secondly, they are more likely to have several members of the family living and sleeping in the same room.

It is amongst the poorer classes that, not only is notification most serviceable in the public good, but that the benefits arising from the notification are also most felt. They, as a rule, derive extreme satisfaction from the visits of the nurse or sanitary inspector, and are only too glad to adopt any measures to help towards their own cure, and to prevent the infection of other members of their household. These people as a rule cannot afford the continuous visits of a doctor, and therefore were they not notified and supervised, their habitations would soon become nests of infection.

Out of 241 patients attending the Paddington Tuberculosis Dispensary, in only 33 cases did the patient have a sleeping room to himself (1). It is here that the Tuberculosis Dispensary occupies such

(1) Annual Report of Paddington Dispensary for Consumption 1909.

an important double function; firstly the patients knowing that they can get medical advice free, attend much earlier, often after only having a cough for a week or two, whereas they would let that cough go on for months before paying a doctor's fee; and secondly by going to the Dispensary and being found to suffer from Pulmonary Tuberculosis,they as it were, notify themselves, as the tuberculosis Dispensary is or should be merely a branch of the organization of the Medical Officer of Health.

In Edinburgh during the first year of compulsory notification of Phthisis, 50% of the cases notified were notified by the Victoria Dispensary for Tuberculosis. (1)

OBJECTIONS TO NOTIFICATION.

The Objections to notification of Phthisis may be looked at from two standpoints:-

1. That of the patients.
2. That of the General Practitioner.

As regards the patient we have already mentioned the fear of being known as a tuberculous subject, but that has been shown in practice to be much over-exaggerated. If a person is suffering from Phthisis and is aware of the fact, his neighbours and friends very soon get to know of it, and the mere fact of notifying him to the Medical Officer of Health adds nothing to this danger. In most towns where notification is in existence, the Medical Officer of Health is most careful never to interfere in any way with the patient

(1) The Antituberculosis Programme.R.W.Philip. Lecture delivered to International Congress on Tuberculosis, Washington, 1908.

against his wishes. It has been found in practice that the patient is as a rule only too glad to take the advice of the Medical Officer of Health or his substitute and to take all the precautions against the infection of others, which are suggested to him.

Other patients again fear that their work may be interfered with if their employer gets to know that they have Phthisis. This is not much to be feared. If the patient is an early and "closed" case, it is hardly necessary that his employment should be interfered with, except for his own good, and if he is an advanced and "open" case, the chances are that he is not physically fit to attend to his work.

Dr. A. Newsholme, Medical Officer to the Local Government Board, makes the following statement:(1)

"No visits to patients are made at workshops or "shops in any town with the administration of which I " am acquainted. To make such visits would be a "foolish mistake."

In Derby, where voluntary notification is in force, no intimation is sent by the Medical Officer of Health to employers of persons notified as suffering from Phthisis. And this is the usual practice in most other towns.

The objection to Notification on the part of the Medical attendant is that in his position of private Medical adviser he has no right to give any information to any one regarding his patient, and if he does so he may lay himself open to awkward consequences.

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(1) The Prevention of Tuberculosis, A.Newsholme, p.329

This may be got over by first obtaining the patient's consent to notification. Of course where compulsory notification is in force, this objection is invalid, as then it is the legal duty of the doctor to notify the existence of this disease to the Medical Officer of Health.

Let us now look more strictly at the value of notification and the arguments advanced for and against it.

Considering the arguments against it first. The objections put forward above with regard to patient and doctor may not be considered as objections to its value, so much as objections to its practicability.

OBJECTIONS.

(1). That pulmonary tuberculosis differs so essentially from the other infectious diseases, that almost every case has, without doubt, been infectious for some time before notification.

(2). Again with regard to the character of the disease, it is of much longer duration than any other infectious disease, thus making the keeping of official records of cases, and the keeping in touch with the cases, a much more difficult and arduous business.

(3). Regarding the diagnosis of the disease much

divergence of opinion exists among medical men especially with regard to early cases, and many more mistakes in diagnosis are likely to arise than in most other infectious ailments.

Objections 1 and 2 are easily answered. Because a system is not perfect, that is no reason why it cannot be of inestimable service. Because a person has been subjected to infection for say three months, is that any reason why he should go on being infected for several years, whereas by notifying the case and advising the patient and his relatives further infection may be minimised. It is agreed that the risk of contracting tuberculosis increases with the time during which the subject is exposed to infection, other things being equal: is not therefore anything which will tend to decrease this period of infection of the greatest value.

Regarding objection No. 2, the difficulty of keeping in touch with Phthisis cases of long duration is admitted, and is almost insurmountable with the staff at present at the command of most Medical Officers of Health. It is here again that the Tuberculosis Dispensary comes into play, where one or more medical men and nurses make it their sole duty to keep in touch with all cases, and follow them in their wanderings from house to house.

The objection regarding difficulty of diagnosis is not very serious for the reason that very few cases are notified which are not phthisis, although there are numerous cases recognised and unrecognised which are not notified.

We will now briefly recapitulate the arguments in favour of some system of notification-

(1). The knowledge thereby imparted to the Medical Officer of Health concerning the number and distribution of cases of phthisis in the area under his control.

(2). The visiting of the patient by the nurse of the Sanitary Authority, and the encouragement of precautions against the infection of other members of the household.

(3). The investigation by the Sanitary Authority as to house infection i.e. whether a phthisis patient formerly resided in the same house.

(4). The disinfection of the house during occupation by patient.

(5). The disinfection of the house after removal of patient and before new tenant is allowed to enter.

(6). The remedying of any insanitary conditions in the patient's house or surroundings.

These are the main points which can be urged in favour of notification with the means at present in the hands of most Medical Officers of Health but where a municipal tuberculosis dispensary is available, certain further benefits accrue.

(1). The periodical visiting of patient by doctor and nurse.

(2). The provision of drugs, and, where absolutely necessary, food and clothing, through the agency of the various charitable institutions.

(3). The thorough examination of other members of the household to discover if possible any other sufferers from the disease.

It is clearly the case that without some system of notification none of the above measures can be adopted, as the Medical Officer of Health is not thus aware of the presence of tuberculosis in any house. Repeatedly cases come to light where previously healthy persons have developed tuberculosis after moving into a house which on investigation is found to have been previously occupied by a consumptive. The removal of this danger in itself is almost sufficient justification for notification. As Dr. Philip has pointed out (1) "All the difficulties which have "from time to time been suggested in relation to the "practical carrying out of notification were all "similarly advanced in connection with the proposed

(1) Brit: Med: Journal, Dec. 1st.1906 R.W.Philip.

"notification of other infectious diseases, and in-
"deed in relation to other state and municipal pro-
"cedure. Experience has shown that these difficul-
"ties rapidly melt away in practice. At the worst,
"they are insignificant, in the present issue, when
"compared with the vastness and gravity of the evil
"to be combated."

Assuming now that notification of phthisis is expedient, i.e., that the advantages quâ the diminution of tuberculosis, are likely to outweigh any disadvantages to the public, the question arises: Should such notification be voluntary or compulsory?

Several towns in England have now had voluntary notification of phthisis in practice for some years, and we will endeavour by means of facts and figures to calculate the effect of this, when combined with other proper administrative measures, on the tuberculosis mortality in the various places.

Regarding Compulsory Notification, only four towns in England have so far adopted this, namely, Sheffield, Bolton, Burnley & Oldham, but we will also consider its effect in ~~Edinburgh and~~ New York in which city it has been in force for some years.

VOLUNTARY NOTIFICATION.

Under voluntary notification any medical practitioner is requested to notify to the Sanitary Authority any case of pulmonary tuberculosis occurring in his ~~district~~ practise. It is usual in most towns, though not in any way compulsory, to give a fee of

2/6d.to the notifying practitioner, this fee being reduced to 1/- if the case occurs in his practice as poorlaw medical officer or officer of a public institution.

It is usual for all cases whether early or advanced to be notified, but in a few towns special recommendations are given to the Medical Practitioners. Thus in Cardiff and Liverpool the Medical Practitioners are requested only to notify such cases as in their opinion will benefit from the attentions of the Sanitary Department. In the Metropolitan Borough of St. Pancras the Medical Practitioners are requested to obtain the consent of patients before notifying them, while in Sheffield, before the introduction of compulsory notification, the medical men were only requested to notify such cases as were in an infectious condition.

It will be well to consider the working of voluntary notification in one of two of the larger towns where it is in operation.

MANCHESTER

Voluntary notification commenced in September 1899 The following figures are taken from the Reports of the Medical Officer of Health (Dr. Niven) (1)

Years.	Notifications	Deaths	Death-rate.
1900	1573	1133	
1901	1339	1142	2.09
1902	1275	1145	2.08
1903	1357	1023	1.85
1904	1202	1106	1.98
1905	1406	988	1.68
1906	1379	1089	1.81
1907	1590	1082	1.80
1908	1503	1089	1.74

(1) Report of Medical Officer of Health for the City of Manchester for the year 1908.

If we consider these figures, it will be evident that the number of deaths somewhat closely approaches the number of notifications. There must therefore be a large number of cases of phthisis which are not notified. In 1908, 343 out of the 1089 deaths from phthisis occurred without previous notification of the disease.

If we take Dr. Philip's calculation (1) that for every death from phthisis there are at least 10 persons in an advanced stage of the disease, then in 1908 in Manchester there must have been approximately 10,890 persons suffering from advanced Phthisis and of these only 1503 were notified.

In Manchester, it may be added, there is every incentive to Medical men to notify cases, as Dr. Niven, the Medical Officer of Health, is keenly interested in the subject, and everything within his power is done both to help the patient and to minimise the risk to others.

BRIGHTON.

This was the first town in England to adopt voluntary notification. It was begun in January 1899. The following figures are of interest and are taken from Reports of the Medical Officer of Health:- (2).

Years.	Notifications.	Deaths.	Deathrate.
1901	153	~~154~~ 237	1.34
1902	224	~~159~~ 227	1.39
1903	316	~~146~~ 248	1.45
1904	363	~~130~~ 259	1.36
1905	308	~~155~~ 241	1.35
1906	373	~~144~~ 268	1.44
1907	299	~~141~~ 255	1.41
1908	270	~~196~~ 226	1.26

(1) R.W.Philip B.M.Journal 1/12/06.
(2) Annual Report of M.O.H. for Brighton, 1908.

Examining these figures, we note that the excess of notifications over deaths, ~~although considerably larger than in the case of Manchester, still~~ cannot be said even in a remote degree, to indicate the probable number of cases existing in the borough. A point to which Dr. Newsholme late Medical Officer of Health for Brighton, calls attention is that cases are frequently re-notified owing to the patient consulting another doctor. Such re-nptifications are not considered in his figures. The average death-rate from pulmonary Tuberculosis in Brighton for the years 1881-1890 was 1.93, while for the years 1891-1900 it was 1.48, thus it is evident that even before the commencement of notification, the phthisis death rate was on the decrease, and that decrease does not seem to have been much accelerated by notification. Again, multiplying the deaths in 1908 by 10, we arrive at the conclusion that there are 2260 persons in Brighton with advanced phthisis and yet only 270 were notified.

LIVERPOOL.

Figures for the last eight years are available from the report of the Medical Officer of Health for 1908. (1)

Year	Notification.	Deaths	Death rate.
1901	1797	1302	1.8
1902	2199	1347	1.8
1903	1874	1258	1.7
1904	1709	1282	1.7
1905	1861	1245	1.5
1906	1842	1170	1.7
1907	2230	1117	1.5
1908	2045	1203	1.6

(1) Annual Report of Medical Officer of Health for Liverpool, 1908.

These statistics of Liverpool show much the same result as those of Manchester and Brighton. It is clear that in this City also there must be a large number of unnotified cases of phthisis. It is somewhat extraordinary that Liverpool should not show a larger number of notifications as there are four hospitals in the city available for the treatment of phthisis.

In considering the number of voluntary notifications of phthisis received by a local authority, it must always be borne in mind that the greater the facilities available by the authority for dealing with the notified cases, the larger should be the number of notifications received. Where a local authority possesses a rate-supported sanatorium, it is clearly to a patient's advantage to be notified, as then they obtain at any rate a chance of being treated at the sanatorium. Where the complete Edinburgh system is available, and where the patient has at his disposal the dispensary, in addition to the sanatorium and other hospitals, it can fairly reasonably be argued that the number of notifications should show a decided increase.

Where compulsory notification exists this argument falls to the ground. One great difference between voluntary and compulsory notification is found in the fact that whereas under voluntary notification no legal responsibility devolves upon

the local authority, under compulsory notification there are serious legal difficulties which will be considered later.

On January 1st. 1909, the Public Health (Tuberculosis) Regulations 1908, came into force, and these regulations will of course be an addition to the system of voluntary notification at present carried out in many towns.

Dr. Forbes, Medical Officer of Health for Brighton (1) considers that these regulations have not increased the number of notifications received in Brighton, as practically all persons in receipt of relief were notified under the voluntary system. It is doubtful whether this will be the experience in all towns. The figures which have been given in this chapter show that a large number of cases of phthisis are brought under the notice of the Public Health Department by voluntary notification, and although there must necessarily be many cases unnotified, this does not in any way diminish the good effect which can accrue from the instruction and general supervision of such as are notified.

COMPULSORY NOTIFICATION.

Under this system of notification serious legal responsibilities are brought into action, and it will be well first to consider exactly how the local authority stands in this matter. In England, if phthisis is made compulsorily notifiable by law; the disease is then regarded as a "dangerous infectious

(1) Annual Report of the M.O.H. for Brighton 1909.

disorder", within the meaning of the Public Health Act 1875 and the Infectious Diseases Prevention Act 1890 and therefore sections 120 - 130 of the former act become applicable to pulmonary tuberculosis. Several local authorities have made application to the Local Government Board to have phthisis made compulsorily notifiable, but the Local Government Board has invariably referred back such proposals, pointing out the serious legal difficulties attached to the proposal.

Let us consider a few of the sections of the Public Health Act 1875 which would be held to apply to phthisis.

Section 125. The Sanitary Authority may make regulations (to be approved by the Local Government Board) for removal to and detention in hospital of any person brought within their district on board ship and infected with a dangerous infectious disease. Penalty for any offence 40/-

Section 126. Imposes a penalty of£5 on anyone (a) wilfully exposing himself while suffering from a dangerous infectious disease, without taking precautions against spreading infection, in any street, public place, shop, inn or public conveyance, or entering any public conveyance without previous notice of his condition to the owner, conductor or driver. (b) who, being in charge of any infected person, exposes him: (c), who gives, lends, sells, transmits, or exposes, unless disinfected, or on the way to be disinfected, any infected bedding, clothes, rags etc.

Section 127. Public conveyances, used as above, must under a penalty, be thoroughly disinfected. The driver or owner need not convey an infected person till he has been adequately compensated.

Section 128. Penalty £20 on any person letting or hiring any infected house or part thereof until it is disinfected to the certified satisfaction of a qualified practitioner. This section includes inns etc.

Section 129. - Penalty £20 or imprisonment for one month, on anyone hiring or offering for hire any house, and returning a false answer when asked concerning the existence in it of infectious disease within the previous six weeks.

Just consider the impossibility of applying most of these sections to Pulmonary Tuberculosis. Under section 126 the patient, for perhaps a matter of several years, would be unable to venture outside his house, travel by rail or tramway or enter a hotel without incurring the risk of prosecution. In practice no Medical Officer of Health would think of enforcing these stringent sections when applied to pulmonary tuberculosis; but at the same time one cannot get away from the fact that by making phthisis a "dangerous infectious disorder", one is bringing all the sections of the act to bear upon it.

The four towns which have so far in England adopted compulsory notification, have got over these difficulties by means of Local Acts and as it is most im-

portant thoroughly to grasp the legal significance of compulsory notification it may be well to give the part of the Sheffield Corporation Act 1903 which applies to this subject, in detail, namely, Section 45.

(1) a. Every registered medical practitioner attending on or called in to visit any person within the city shall forthwith on becoming aware that such person is suffering from Tuberculosis of the Lung send to the Medical Officer of Health a certificate on a form to be supplied to him gratuitously by the Corporation, stating the name, age, sex and place of residence, and employment, or occupation (so far as can be reasonably ascertained), of the person so suffering and whether the case occurs in his private practice, or in his practice as medical officer of any hospital, public body, friendly, or other society, or institution.

b. Any such Medical practitioner who fails to give such certificate shall be liable on summary conviction to a fine not exceeding forty shillings.

c. The Corporation shall pay to any such Medical practitioner for each Certificate duly sent by him in accordance with this section a fee of two shillings and sixpence if the case occurs in his private practice, and of one shilling if the case occurs in

his practice as medical officer of any hospital, public body, friendly, or other society, or institution.

d. A payment made to any medical practitioner, in pursuance of this section, shall not disqualify that practitioner from serving as a member of the Corporation, or as a Guardian of a Union situate wholly or partly in the City, or in any municipal or parochial office.

(2) a. Where the Medical Officer of Health certifies that the cleansing and disinfecting of any building (including in that term any ship, vessel, boat, tent, shed, or similar structure used for human habitation) would tend to prevent or check Tuberculosis of the Lung, the Town Clerk shall give notice in writing to the owner or occupier of such building that the same or any ~~any~~ part thereof will be cleansed and disinfected by the Corporation, at the cost of the Corporation, unless the owner or occupier of such building informs the Corporation within 24 hours from the receipt of the notice, that he will cleanse or disinfect the building, or the part thereof, to the satisfaction of the Medical Officer of Health, within the time to be fixed in the notice. If within 24 hours from the receipt of such notice the owner or occupier

of such building has not informed the Corporation as aforesaid, or if having so informed the Corporation, he fails to have the building or the part thereof disinfected as aforesaid, within the time fixed by the notice, the building or the part thereof shall be cleansed and disinfected by the officers, and at the cost of, the Corporation, under the superintendence of the Medical Officer of Health. Provided that any such building, or part thereof, may without any such notice being given, as aforesaid, but with the consent of the owner or occupier, be cleansed and disinfected by the officers of, and at the cost of, the Corporation under the Superintendence of the Medical Officer of Health.

b. For the purposes of carrying into effect the provisions of this subsection, the Corporation may by any officer authorised in that behalf who shall produce his authority in writing, enter on any premises between the hours of ten o'clock in the forenoon and six o'clock in the afternoon.

c. Every person who shall wilfully obstruct any duly authorised officer of the Corporation, in carrying out the provision of this sub-section, shall be liable to a penalty not exceeding forty shillings, and if the offence is a continuing one to a daily

penalty not exceeding twenty shillings.

(3) a. The Medical Officer of Health generally empowered by the Corporation in that behalf may by notice in writing, require theowner of any household, or other articles, books, things, bedding, or clothing, which have been exposed to the infection of Tuberculosis of the Lung, to cause the same to be delivered over to an Officer of the Corporation for removal, for the purpose of disinfection, and any person who fails to comply with such requirement, shall be liable on summary conviction to a penalty not exceeding five pounds.

b. Such articles, books, things, bedding, and clothing, shall be disinfected by the Corporation and shall be brought back and delivered to the owner free of charge.

(4) If any person sustains any damage, by reason of the exercise by the Corporation of any of the powers of sub-sections (2) & (3) of this section, in relation to any matter as to which he is not himself in default, full compensation shall be made to such person by the Corporation, and the amount of Compensation shall be recoverable in, and in case of dispute may be settled by, a Petty Sessional Court.

(5) No provisions contained in any general or local Act of Parliament, relating to infectious disease, shall apply to Tuberculosis of the Lung, or proceedings relating thereto under this section.

(6). All expenses incurred by the Corporation in carrying into effect the provisions of this section shall be chargeable on the District Fund and General District Rate.

(7). The Corporation shall cause to be given public notice of the effect of the provisions of this section by advertisement in the local newspapers, and by handbills, and shall give formal notice thereof by registered post to every medical practitioner in the City, and any other registered medical practitioner known to be in practice in the City, and otherwise in such manner as the Corporation think sufficient, and this section shall come into operation at such time not being less than one month after the first publication of such advertisement, as aforesaid, as the Corporation may fix.

(8). The provisions of this section shall cease to be in force within the City at the expiration of seven years from the date of the passing of this Act, unless they shall have been continued by an Act of Parliament or by Provisional Order made by the Local Government Board, and confirmed by Parliament, which Order the Local Government Board are hereby empowered to make in accordance with the provisions of the Public Health Act 1875.

(9). The term 'Medical Officer of Health' in this section shall mean the Medical Officer of Health for the time being of the City, or any person duly authorised to act temporarily as Medical Officer of Health for the City.

Special notice should be taken of sub-section 5 of this act, which effectually disposes of the difficulties previously exemplified.

In Scotland, by a Local Government Board circular dated 10th. March 1906, it is distinctly stated that "Pulmonary phthisis (i.e. tuberculosis of the lungs or consumption) is an infectious disease within the meaning of the Public Health (Scotland) Act 1897." It is also set forth in the same authority that sections 46, 47 and 48 and all other provisions of the Statute, with regard to disinfection, will be available in dealing with Pulmonary Phthisis, and it will be the duty of the Local Authority to secure that whenever necessary, these provisions are enforced.

Again it is stated that "The provisions of the Public Health Act as to removal of cases of infectious disease to hospital (section 54) and as to provision of hospitals (section 66), are available for dealing with cases of pulmonary phthisis as with cases of other infectious diseases."

With reference to compulsory notification of phthisis in Scotland, "It is open to the Local "Authority, with the approval of the Local Government "Board, to add pulmonary phthisis to the list of "diseases notifiable under the Infectious diseases "(Notification) Act 1889. The Board will be prepared "to give favourable consideration to any application, "provided they are satisfied that the Local Authority "is in a position, and is ready, to deal effectively "with the cases notified to them."

Should any Medical Officer of Health in Scotland, however endeavour to enforce the provisions of the Public Health (Scotland) Act 1897 in cases of pulmonary tuberculosis there would without doubt be some difficulty in obtaining a conviction, and as section 56 of that act imposes a penalty of £5 on any person with infectious disease exposing himself, the adoption of this act in Scotland regarding phthisis is open to the same objections as the adoption of the Public Health Act 1875 in England.

The Public Health (Scotland) Amendment Act 1907, amends slightly some clauses of the 1897 Act, especially Sec. 57 which now allows children to return to school upon a certificate from a general practitioner that 'proper precautions against 'spreading the disease' have been taken. This of

course applies to Phthisis and may give rise to some difficulty in connection with other infectious diseases. The working of this matter in Scotland has however been fairly smooth for the main reason that Medical Officers of Health have not, as a rule, tried to enforce strictly certain sections of the act which clearly are impracticable with reference to Pulmonary Tuberculosis.

It is worthy of notice that the Local Government Board (Scotland) will only give consent to compulsory notification of phthisis in cases where the Local Authority is competent to deal effectively with the cases notified. This after all is the key to the whole problem. Notification to be of any value must be backed up by effective dealing with the patient.

We will now consider the figures, with reference to compulsory notification, obtained in a few towns where this system is in operation.

SHEFFIELD.

Compulsory notification was adopted in Sheffield in 1903 under a local act. Voluntary notification had previously been in operation since 1899.

The following figures taken from reports of the Medical Officer of Health (1). are of interest:-

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(1). Annual Report of the Medical Officer of Health for Sheffield 1908.

Year.	Notification.	Notifs.	Deaths.	Death Rate.
1900	Voluntary	585	539	1.4
1901		648	580	1.5
1902		739	493	1.2
1903		918	573	1.3
1904	Compulsory	1216	536	1.2
1905		1057	490	1.1
1906		1122	452	1.0
1907		1238	523	1.1
1908		1299	565	1.2

These statistics show a distinct increase in the number of notifications received under the compulsory system as compared with those received under the voluntary system.

In 1908 there occurred 565 deaths from Phthisis while 1299 cases of phthisis were notified, this being much in advance of any figures obtained under voluntary notification either in Sheffield or in any of the towns previously considered. In spite however of this increase in the number of notifications, there were 25 deaths from phthisis in Sheffield in 1908 which occurred without previous notification.

At the end of the year 1908 there were 1323 cases of phthisis on the Sheffield books, and of these 93 were living in common lodging houses. Just consider the value to the public health in having these 93 cases alone watched over and advised by the sanitary authority! This would have been quite impossible without notification. Dr. Scurfield, Medical Officer of Health for Sheffield states: "The provisions of

"the Act are being carried out without friction, and
" I am of opinion that the work is doing a consider-
"able amount of good."

BOLTON.

Voluntary notification was in force in Bolton between 1902 and 1905, after which date, under section 52 of the Bolton Corporation Act 1905, the notification of Pulmonary Tuberculosis became compulsory for a period of five years. A clause in this section differentiates between phthisis and other iffectious diseases as regards legal proceedings. The following are the figures obtained since voluntary notification:

Years	Notification.	No: of Notifis.	Deaths.	Deathrate
1902)		80	253	1.47
1903)	Voluntary	92	218	1.25
1904)		93	221	1.25
1905)		150	210	1.17
1906)		262	202	1.11
1907)	Compulsory	195	186	1.01
1908)		202	216	1.16
1909)		240	216	1.15

Here again, as in the case of Sheffield, we see a large increase in the number of notifications since the adoption of compulsory notification, but this effect is to a large extent spoiled by the fact that the number of deaths approximates too nearly to the number of notifications, showing that there must of necessity be a large amount of unnotified phthisis in the borough.

In Edinburgh, compulsory notification has only been in force since March 1907 and the results are therefore as yet not of sufficient value to merit examination. New York was the first city in the world to adopt notification of phthisis. In 1893 voluntary notification was commenced and in 1897 a form of compulsory notification was instituted. Judging from the death rate from phthisis in New York tabulated below, notification there seems to have given good results, but it must be remembered that New York is not content with notification alone, but is one of the most keenly active towns in adopting all the various measures against tuberculosis included in the Edinburgh system. It possesses municipal tuberculosis dispensaries, Hospitals for advanced cases, and sanatoria, in addition to which the sanitary authority is most enthusiastic in enforcing all the methods of prevention usually employed.

Death Rate from Pulmonary Tuberculosis per 10,000 in New York.

1890 -	34.1	1898 -	25.1
1891 -	31.1	1899 -	26.0
1892 -	29.5	1900 -	25.7
1893 -	29.1	1901 -	25.0
1894 -	25.7	1902 -	22.9
1895 -	27.8	1903 -	25.0
1896 -	26.2	1904 -	23.7
1897 -	25.0	1905 -	23.8

S U M M A R Y.

That a system of notification of phthisis is absolutely necessary, in order to deal in any way effectively with the disease, will without doubt

be granted. Whether that system be voluntary or compulsory must be left largely in the hands of the local authority. It has been our endeavour to show the results obtained by each method, and the advantages and disadvantages associated with each.

Compulsory notification, under a local act, excluding phthisis from many of the penalties attached to other infectious diseases, seems the most satisfactory means of accomplishing our object, which, after all, is the obtaining of the maximum amount of information re phthisis, at a mimimum inconvenience to general practitioners and the public.

It may be interesting to conclude this matter with a short table illustrating briefly the effects of voluntary and compulsory notification in certain of the towns. The figures in this table are obtained by estimating the probable number of cases of phthisis in the town by multiplying the number of deaths from phthisis by ten; the number of notifications received is then calculated as a percentage of the probable existing cases. The figures are calculated for the years 1907 & 1908, thus showing the latest working of either scheme.

Manchester.	1907	=	14.6%
(Voluntary)	1908	=	13.8%
Brighton	1907	=	21.2%
(Voluntary)	1908	=	21.4%
Liverpool	1907	=	19.9%
(Voluntary)	1908	=	16.9%
Sheffield	1907	=	23,6%
(Compulsory)	1908	=	22.9%
Bolton	1907	=	10.4%
(Compulsory)	1908	=	9.3%

It is somewhat difficult to explain why under either system so small a percentage of the probably existing cases should be notified. There is on the part of most general practitioners a distinct hesitancy in notifying a case of phthisis, unless well advanced, and this may account for some cases.

Again, the diagnosis is delayed in many cases, & in some is only arrived at shortly before death. Without doubt however, the greatest part of this deficiency of notifications is simply due to a lack of interest on the part of the general practitioner, and one can only hope that as time goes on, this may gradually disappear.

THE DISPENSARY.

It is doubtful if even yet many local authorities have fully grasped the significance of the Tuberculosis Dispensary.

To the Medical Officer of Health it forms an invaluable asset in his fight against tuberculosis. It is almost impossible to have any co-ordinated scheme without the dispensary as the basis of operations, and yet it is the one part of the scheme of which it seems impossible to make local authorities realise the value. A local authority in many instances finances a sanatorium, or a certain number of beds for advanced cases, but fights shy of the expense of a dispensary for tuberculosis.

Several Medical Officers of Health seem afraid

that the Tuberculosis dispensary will run contrary to the interests of the general practitioners, but this most emphatically has not been the experience either in Edinburgh or in the Metropolitan Borough of Padding ton. In both these places it has been found that the Medical men have been only too willing to co-operate in every way with the dispensary, and it is their common practice to send patients to the dispensary, either for confirmation of diagnosis, or for the purpose of having their home condition supervised by the Dispensary.

Let us look more strictly at the value of the Dispensary to the Medical Officer of Health. The dispensary should be the head-quarters of his fight against tuberculosis. To it all the patients of the poorer class should be directed from other hospitals in the town, and it should be common knowledge in the town that any poor person suffering from cough or "chronic cold" can obtain advice and treatment at the dispensary. Just consider what an immense and otherwise untouched field of tuberculosis this places at the disposal of the Medical Officer of Health. The majority of these people would not in all probability consult a medical man until the disease was too far advanced for there to be any reasonable expectation of cure. Others again would be treated with bottles of cough mixture at the various hospital out-patient departments, but there would be no control over their home lives or surroundings and they would rapidly infect the other members of their households. At the best the treat-

ment of phthisis at our various out-patient departments can only be described as tinkering, without the least attempt to go to the root of the trouble. At the Tuberculosis Dispensary the home conditions are carefully enquired into, and the Medical Officer of Health is thus enabled to remedy any insanitary conditions so far as is in his power.

Another aspect of the dispensary of enormous value in preventive medicine is the physical examination of all 'contacts', or other members of the patient's household. The economic value of this process can be well understood by anyone who has seen the enormous prevalence of family infection, and the numerous cases of phthisis which are thus brought to light and treated while in an incipient stage.

Let us look at the practical working of the dispensary.

The staff will of course depend on the size of the town and on the number of patients availing themselves of its benefits; also the premises required will vary according to the finances available.

As a model one may consider the Victoria Dispensary for Tuberculosis in Edinburgh. Here the staff consists of:-

1. Four qualified physicians who attend when the dispensary is open. Two of these are honorary and two receive small remuneration for their services.
2. A Nurse who has had training in consumptive work, and who helps at the dispensary, and visits

the patients in their homes.

3. A resident caretaker who gives his entire time to the institution, and helps the medical staff by entering the patients' names in a register, and regulating their movements towards the different rooms.

4. A qualified dispenser who attends at the dispensary at stated times.

5. A volunteer Committee of ladies who take charge of the more distressing cases which need financial aid. The endeavour is to co-operate with charitable societies on behalf of the patients.

The premises required are as follows:-

1. Two Consulting-rooms, one of new and one for old patients.
2. A laryngoscopic room.
3. A general Office.
4. A large waiting room.
5. Two dressing rooms (male and female)
6. A small laboratory for bacteriological examinations.
7. A drug store.

Let us now look at the work performed by the different officials.

The two honorary Medical Officers attend when the Dispensary is open and examine new patients, reporting if necessary to the patient's own doctor on her or his condition. Great care is taken never to give advice or treatment to any patient who is under the care of a private doctor, unless asked to do so by a note from the doctor.

The two paid medical officers perform the duties

above mentioned in the absence of the honoraries, and in addition, see all old patients, and renew prescriptions, and advise generally as regards treatment.

They also examine the sputa of patients, and notify cases of phthisis to the Medical Officer of Health. They select early cases which may be suitable for treatment in the Sanatorium, and place their names upon the waiting list for admission to that institution; or again, they advise the Medical Officer of Health that certain patients should be removed to the hospital for advanced cases in order that they may not infect those living in the same house. They also advise the Medical Officer of Health as to the disinfection of infected houses.

In addition to this work at the dispensary these medical officers also make domiciliary visits to the dwellings of patients for the double purpose of investigating the patient's environment, and of determining the possible presence of tuberculous infection in other members of the household.

As regards the work of the nurse, it is best expressed perhaps in the words of Dr. Philip himself(1):

"She visits the homes of patients and readily "gains their confidence by her interest in their wel- "fare. She instructs the patients and their friends "both as to the treatment and prevention. In co-op- "eration with the visiting physician, she reports "regarding the patient's residence and environment "according to a special schedule of enquiry."

(1) R.W.Philip Public Aspects of the Prevention of Consumption, B.M.J. Dec.1st.,1906.

It will thus be seen what an important element the nurse is in this branch of the scheme, and a capable tactful nurse can do an enormous amount of good in this connection.

Should a patient be too advanced for admission to the Sanatorium, and yet by no means a dying case, and if his home conditions are such that he can have a bedroom to himself, and have a reasonable amount of attention, then he is treated at home, and visited by both doctor and nurse, and medicines supplied from the dispensary. The nurse's constant supervision ensures the open-air treatment being persevered with, and all precautions being taken to avoid infection of other persons in the house.

Every patient at the dispensary is presented with a printed card of instruction regarding treatment by open-air method, and prevention of infection of others by spitting, kissing, etc. If the patient is financially unable to buy his medicine he is provided with it at the dispensary at the charge of 1d. per bottle.

The ideal system should possess a municipal dispensary. The Victoria dispensary at present in existence in Edinburgh is entirely a charitable institution connected with the Royal Victoria Hospital, and only connected with the Public Health service by courtesy, and for general usefulness, and convenience of working, with maximum benefit to all concerned.

According to a Local Government Board (Scotland) circular (1) of 1906 "The Municipal or District "Phthisis Dispensary ought to be the central bureau

(1) L.G.B. (Edinburgh) Circular Public Health No. 1, 1906.

"of information. It should keep a register of all "sanatoria, hospitals, infirmaries, work colonies, "convalescent homes, parochial hospitals, private "houses, phthisis Committees and all other institu- "tions, or organisations, that either within the dis- "trict or without, can be made available for the "inhabitants."

It will thus be seen that every variety of case may be suitably dealt with by the local authority.

Let us consider a local authority having the whole Edinburgh system at its command. The Medical Officer to the Dispensary examines the contacts of an advanced case of phthisis, living in the same house with six other members of the same family, and finds, let us say, two members of the family in an early stage of the disease. He recommends the removal of the advanced case to the hospital for advanced cases, and the two early cases to the Sanatorium. In perhaps 3 or 4 months those two cases are discharged cured from the the sanatorium, and can become once again useful members of the community. Had there been no dispensary, the result of this would probably have been that the advanced case would have continued to infect all the other members of that household, (and this is no unusual state of affairs), until probably when the case came under the notice, ~~of the Medical Officer of Health~~, all seven cases might require removal to the hospital for advanced cases, where they must be kept at the expense of the local authority until they die, or in rare cases until they are sufficiently

recovered to be considered non-infectious.

It is in instances such as the above (an instance by no means rare), that the true economic aspect of the tuberculosis dispensary is brought out.

It may be, and doubtless is, an additional expense to be considered, but by its work and the ramifications of its interests, it more than compensates in the saving which it effects in other directions.

It is becoming more and more manifest that if the public health authorities are to deal really effectively with phthisis, they must get at the early cases, they must get at the sufferers in their homes, and they must prevent the spread of infection from one member of a family to another.

This can best be accomplished by means of the tuberculosis dispensary and for this reason, if for no other, it must commend itself to every thinking Medical Officer of Health.

It is not our intention here to discuss the amount of the organisation and clerical work of the Medical Officer of Health, in connection with phthisis, which should be transacted at the dispensary. This will depend, firstly, upon whether the dispensary be supported by voluntary or municipal funds, and secondly, upon the personal wishes of the Medical Officer of Health. Should the Dispensary be a municipal institution, and under his own control, it seems likely that he will deem it advisable to leave the transaction of all phthisis business to the dispensary, and thus clear his office of this ever growing work.

Where a municipal dispensary exists the following arrangements might with advantage be adopted:-

(1) All cases of phthisis should be notified to the Medical Officer of Health at the Dispensary.

(2) Instructions for disinfection of houses etc. should be issued from the Dispensary.

(3) Instructions for visiting the cases should be issued from the Dispensary.

(4) Notices of discharge from Sanatorium should be sent to the Dispensary.

(5) Patients at the Dispensary should be classified as to whether fit for removal to sanatorium, hospital for advanced cases, or for treatment at home.

It will thus be seen that, in a properly co-ordinated scheme, the dispensary should act as the organizing centre for the whole, and in addition should form, through its dealing with incipient cases, the most important branch of the system from the point of view of preventive medicine.

THE SANATORIUM.

Although it is freely admitted that a hospital for the reception and isolation of advanced cases of phthisis is a necessity, and comes within the province of the Medical Officer of Health just as does a hospital for the isolation of other infectious diseases, yet it is doubted by many whether a sanatorium, whose primary object is the cure of early cases, should be included in a scheme of preventive medicine against phthisis.

This view is often urged by those who wish to curtail the public health expenditure.

When one considers the larger outlook of the sanatorium, and the ultimate aim of its existence however, it is clear that it more than justifies its position in any scheme formulated by those interested in the prevention of Tuberculosis.

It is not our object here to deal in detail with the work of a sanatorium, but merely to point out its position in the co-ordinated scheme.

There are many cases which come under the notice of the health authorities where efficient home treatment of phthisis is an impossibility owing to inadequate housing accommodation, insufficient aero-therapy, or constant re-infection from another more advanced case.

If no sanatorium existed cases such as these would simply drift on until they became seriously affected, involving removal to the hospital for advanced cases, and their detention therein at the expense of the local authority until their death.

Where no hospital for advanced cases existed such cases would of necessity remain at home constantly infecting an increasing number of persons.

It was pointed out earlier how by early removal of such cases to the sanatorium, a treatment of a few months duration might render them again able to earn their own livings.

Tuberculosis is acknowledged by competent authorities to be one of the greatest, if not the greatest, cause of pauperism in this country. This means an immense and constantly increasing drain on

the resources of the community. A rate-supported sanatorium, taking its proper place in the co-ordinated scheme, should be a most powerful preventive of pauperism through tuberculosis, and thus should, in a short time, fully compensate financially for its initial expense and annual expenditure.

A difficulty has been experienced in some localities in getting wage-earners, especially fathers of families, to undergo sanatorium treatment. This is an acknowledged difficulty, due to the natural desire on the part of every father to support his wife and children as long as possible. In the present day, the difficulty of obtaining employment is constantly facing the working classes, and a man is afraid that if he vacates his position for a few months, he may be unable to regain it on his return. This matter was discussed in some detail at the Tuberculosis Conference held in Edinburgh in 1910, and the trend of feeling seemed to be that some fund either national, local, or voluntary, should be inaugurated for the support of families of phthisical patients while the wage earner is undergoing sanatorium treatment. It was also urged that employers of labour should do their utmost to reinstate workers who have temporarily resigned their employment for this purpose.

In addition to the cure of the individual patient, the sanatorium has an immense power for good over the lives of those with whom a discharged patient is brought into contact. In the sanatorium he has learned the value of fresh air, sunlight, and a physiological life, and on his discharge in the majority of cases, he continues this life and illustrates to others its good effects. This may be termed the educative side of the sanatorium. So much has this been realised that, in certain towns, patients are only kept in the sanatorium until they have learned to look after themselves properly, and not until they are properly cured. This may have economic advantages but it is not to be recommended, as it is better to thoroughly cure a small number than to half cure a large number.

The sanatorium is quite as necessary a factor as is the hospital for advanced cases, and it is moreover what one may call a saving institution, as the saving in money to the community, of one prospective pauper re-instated in a wage earning position, more than compensates for his few months of treatment in the sanatorium.

Since the year 1897 working men's insurance societies in Germany have, in self interest, spent £10,550,000 sterling in building sanatoria.

The percentage of patients who, five years after treatment were still able to work and did not require any allowance from their insurance fund was 27,31,32, &31 for years 1897,1898,1899 & 1900 respectively.

THE WORKING COLONY.

This may be considered from an administrative point of view merely as an extension of the sanatorium. It is understood that cases after undergoing sanatorium treatment, should be transferred for some time to a working colony until they are medically fit to resume their employment. The great benefit derived from this institution is that many cases are thus made so thoroughly fit for their work before discharge, ----------that there is thus less risk of their having a recrudescence of the disease. One of the greatest arguments against sanatorium treatment is that, in many instances, after the patient re-starts his work his disease breaks out afresh. It is with a view to preventing this, as much as possible, that the working colony is brought into the scheme.

One of the greatest difficulties in dealing with patients on their discharge from sanatorium is to find suitable work for them. One does not want a patient to go straight from a sanatorium into a stuffy office and so undo the good he has received.

All kinds of manual labour should be undertaken at the working colony, and if properly managed it is hoped that it will be self supporting.

The first working colony for Consumptives was opened in Edinburgh in July 1910 and its effects and possibilities are awaited with interest.

It is what one may call a refinement of the scheme for dealing with early cases.

To the Medical Officer of Health this will only commend itself after he has got all the other branches in working order. It is perhaps the least absolutely essential part of the scheme, but nevertheless one for which there is a distinct necessity if one is to get the maximum benefit from the Sanatorium.

HOSPITAL FOR ADVANCED CASES.

It will be readily admitted that, if it is the duty of the Sanitary Authority to erect hospitals for the isolation of cases of infectious disease, such as Scarlet Fever and Diphtheria, it is equally, if not more urgently their duty, to maintain an institution for the isolation of advanced cases of Phthisis. It is such cases that are by far the most potent cause of the infection of other persons, and especially amongst the poorer classes, where home isolation is a practical impossibility, it is the clear duty of the local authority to remove such persons to an isolation hospital.

The Local Government Board for Scotland in a circular dated March 1906 stated: "that the isolation "of such dangerous cases is a primary duty of a local "authority".

With this statement surely everybody who has given the matter serious thought will be in agreement.

It is now becoming comparatively common in this country to find that so many beds in the local fever hospital are devoted to the reception of advanced

cases of phthisis. This is a system which appears to answer the purpose in a satisfactory manner without materially increasing the expenditure of the isolation hospital.

A matter to which attention may be drawn is that, under some local authorities, it is the custom to have a certain block of the isolation hospital devoted to phthisis, and to this block patients in all stages of the disease are admitted, prefemence being given, in most instances, to those patients whose home conditions are unsatisfactory.

The above system is not one to be encouraged. It is impossible to treat early cases of phthisis satisfactorily in the same wards where patients are dying of the disease. Both mentally and physically this has a deleterious effect on the incipient cases.

Cases suitable for sanatorium treatment should be kept entirely apart from cases sent to a hospital for advanced cases, for the purposes of isolation.

A case such as the following well illustrates the need for the isolation of advanced cases of phthisis: (1): The patient, a man of 40, lived in a two-roomed house with his wife aged 34 and three children ages varying from 14 to 6. The patient was confined to bed and was hardly able to move himself about. His efforts at expectoration resulted in the deposition of sputum over bed-clothes and floor. His wife and youngest child slept in this same bed, and all the children were constantly playing about in the room, on the floor, and climbing

(1) Borough of Derby, Phthisis Records, 1910

up on to the bed.

Surely such a state of affairs could hardly present a better opportunity for infecting the other members of the patient's family. This case occurred in a town where no isolation treatment of phthisis was available, with the result that, although his home conditions were remedied so far as the Medical Officer of Health was able, nevertheless before his death he had infected his wife and one of the children.

It is my contention that such cases can only be suitably dealt with by the institution of hospital isolation, and this forms a most important factor in the Edinburgh system.

Before leaving this subject, it may be well to emphasize a fact which is apt to be neglected, namely, that all such patients, sent to the Isolation Hospital, should be kept there until their deaths, unless they can be discharged without any risk of infecting other people.

This is a most important point, if full success is to be derived from the isolation of such cases.

DISINFECTION OF TUBERCULOUS HOUSES.

It is now a recognised fact that the infection of tuberculosis can be transferred from one person to another through the agency of an infected room, bedding or clothing. Tubercle bacilli have been demonstrated on the walls and floor of a room occupied by a consumptive patient, and countless cases

are on record of later occupants of a tuberculously infected room becoming phthisical.

In Manchester and Berlin special work has been done in this regard in order to estimate the probability of house infection. Dust was collected from rooms occupied by patients suffering from phthisis, and guinea-pigs were inoculated from this dust. The results are given below:- (1)

B E R L I N

No. of houses examined.	Positive Results.	Negative Results.	Percent: of Posit:
28	19	9	67%

M A N C H E S T E R.

31	19	12	61%

It is thus seen that in the great majority of rooms occupied by phthisis patients, unless scrupulous care and cleanliness are enforced, there are vast possibilities for the infection of other persons.

Under these circumstances it is clearly incumbent upon the Medical Officer of Health to mitigate as far as possible this source of infection.

Let us look at his position in the matter. In England in a town where phthisis has been made a "dangerous infectious disorder" within the meaning of

(1) H.Coates, Thesis, Victoria University 1901.

the Public Health Act 1875, the power of the Medical Officer of Health is identical with that which he holds with reference to the disinfection after any other infectious disease. Where however phthisis is not considered in the above light, the path of the Medical Officer of Health is not so clear. The procedure usually followed in towns where voluntary or no notification is in force is as follows:-

On receiving notice of the death of any person from tuberculous disease, a sanitary inspector calls at the house, and requests the occupier to permit the disinfection of the rooms occupied by the deceased. He at the same time explains fully the infectious nature of the disease, and the great need for disinfection in the interest of the health of the present and future occupiers. In the majority of cases no opposition is offered, and disinfection is accordingly carried out. Should however the occupier refuse to accede to the requests of the Health Department, nothing further can be done. It is unfortunately impracticable to disinfect the house before it is occupied by a future tenant, unless the new tenant has known of the existence of the disease, and requests the Medical Officer of Health to perform disinfection. It is quite impossible for the Health Department to receive notice of all changes in tenancy of tuberculously infected houses, after the death of the patient. While the patient is alive, and the case being periodically visited by a nurse or other official, notices of removal are of course available

and the house is accordingly disinfected unless the new tenant objects.

In Scotland by means of sections 46,47, & 48and others of the Public Health (Scotland) Act 1897 the Medical Officer of Health has now full powers as regards disinfection of tuberculously infected houses etc., and does not require to obtain the patient's consent.

Pulmonary Tuberculosis being a disease of such long duration, the question arises whether in towns where some system of notification exists, disinfection should not be carried out previous to the death of the patient.

At what periods and in what circumstances such disinfection should be performed is a matter of opinion, but I suggest the following as the most essential.

1. On receipt of Notification (a) All rooms in the patient's house should be disinfected.
   (b) All bedding which has been used by the patient and which is going to be used for other members of the household should be disinfected.
   (c) The workplace of the patient should be disinfected.
2. At frequent intervals if patient is treated at home, all rooms occupied by him since the first disinfection should be again disinfected.
3. On the Removal of the Patient to a Sanatorium, or other hospital, the house, bedding, clothing, and all utensils used by the patient should be disinfected.

4. On Removal of Patient to another House, the house previously occupied must be disinfected.

5. On Death of Patient thorough disinfection of house, bedding, etc. should be performed.

It is also important that the disinfection should not be left to the patient's relatives or friends, but that it should be undertaken by a thoroughly experienced member of the sanitary staff.

Apart altogether from the disinfection of houses known to be infected with tubercle, it is well for the Medical Officer of Health to periodically, if possible, cause disinfection to be performed in places which he has reason to suspect may be the cause of spreading infection.

In this regard particular attention should be paid to public houses, churches, theatres, public halls, schools, railway stations, tramcars, railway carriages, and vehicles for public conveyance.

In several towns it is the custom to wash out the tramcars nightly with a disinfectant solution, and although it is doubtful whether the solution used is of sufficient strength for bactericidal purposes, the practice is certainly one to be encouraged.

It may be as well to consider here what really efficient disinfection consists of when undertaken to destroy the tubercle bacillus. Various authorities hold various opinions on this subject, and different methods are employed by different munici-

palities.

The question first resolves itself into two main divisions, firstly gaseous disinfection, and secondly wet disinfection. Among the gaseous disinfectants, the most commonly used is sulphur, or more accurately, sulphurous acid vapour. Delépine (1) has tested the effect of this method of disinfection with regard to tubercle bacilli. He used 1 lb. of sulphur to 825 cubic feet of space and exposed the tuberculous material for four hours.

Out of six experiments the material remained virulent in 4 cases i.e. in 66% of the experiments disinfection was not efficient.

Another gaseous disinfectant which was formerly used to some extent, especially in Manchester, is Euchlorine. This is generated by means of crude hydrochloric Acid acting upon chloride of lime. Delépine (2) conducted 13 experiments with this method of disinfection for tubercle bacilli. In 11 cases the material remained virulent, i.e. in 84% of cases disinfection was not efficient. The disinfection was performed in the usual way by members of the Manchester Sanitary Staff.

Formic Aldehyde or Formaldehyde is another gaseous disinfectant. A special lamp is necessary for this method, into which methyl alcohol is poured; the methyl alcohol vapour being made to pass over finely divided platinum. Trillat's autoclave is a well-known form of this apparatus. More recently

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(1) Delépine British Medical Journal Feb.16th 1895
(2) Delépine " " " Nov. 4th 1893.

special formaldehyde tablets have been put on the market, which are burnt in "Alformant" lamps. 25 tablets are used to every 1000 cub. feet of space. Delépine (1) sums up his results with this method thus: "Formaldehyde has therefore penetration powers "probably greater than those of most other gaseous "disinfectants. The bacillus tuberculosis was killed "whether in dry or moist state, even when placed in "deep narrow recesses, or embedded in a thick layer of "sputum."

It is generally admitted that formaldehyde is the best gaseous disinfectant we possess. Objections to its use are, firstly, the cost, secondly some complexity in the mechanism and working of the lamps, and thirdly the irritating action of the vapour on the eyes and nose of those engaged in re-opening the room after disinfection.

Turning now to the wet methods of disinfection, the first to be considered is Chlorinated Lime; this should be used as a 10% solution and applied directly to the walls etc. Delépine considers that this is the best method of disinfecting the dwellings of the poor. The procedure adopted in Manchester in using this method is as follows:-

A solution of chlorinated lime of the strength of 1½ ounces to the gallon is used. The wall-paper is thoroughly saturated with this solution, applied with a soft brush and is then stripped from the walls.

The bare walls, the ceiling and floor are washed over several times with the solution, and any articles

(1) Delépine, Experiments on disinfection of rooms with gaseous formaldehyde. Journal of State Medicine, 1898.

of furniture which will admit of such treatment are similarly washed over. The results obtained by this method are thoroughly satisfactory, but the process is one involving much expenditure of time and trouble.

Formaline spray is a very commonly used wet method of disinfection. A 40% solution is taken and of this 4 oz. to the gallon of water are used. Several forms of spraying apparatus are on the market, two of the best being the "Formalide" and the "Invicta". The points to be aimed at in a good spray are fineness of division and suitable velocity. Blum(1) points out that micro-organisms are only killed in somewhat strong solutions(2%) of Formalin. A paper by Rideal & Slater (2) confirms this, and they observe that their results would place Formaldehyde amongst the first 3 or 4 antiseptics in Koch's tables. The solutions are without any ill effect on clothes etc. This is one of the best, most certain, and most cleanly, methods of disinfection, and is a most excellent way of dealing with tuberculously infected rooms.

The only other wet method of disinfection which need be considered is that known as Esmarch's method. It should only be used in houses that are in a clean condition apart from the specific infection. The wall paper is well rubbed with bread crumb. Floors, painted walls, and woodwork, are washed with soap and water and ceilings limewashed. Bedding etc. is removed and disinfected by steam. The method requires care and takes a considerable time.

(1) Blum. Münsch Med. Woch. 1893 p. 32.
(2) Rideal & Slater, Lancet, April 21st. 1894.

We have endeavoured here merely to give shortly the essential facts connected with six of the most commonly used methods of disinfection of houses. In addition to this however it is essential that all bedding, clothing etc. be removed and thoroughly disinfected by steam.

In cases of tubercle infection, one may say that formaldehyde vapour, formalin spray, or washing with a solution of chlorinated lime, are equally efficaceous. In only a few places is sulphur fumigation used for tubercular houses, and it should be discountenanced as also should be the use of chlorine vapour.

The thorough disinfection of houses is one of the most important parts in our whole scheme against tuberculosis, and one which should receive much care and and attention from the Medical Officer of Health and his subordinates.

THE MEANS AVAILABLE in some of our Larger Towns for dealing with Tuberculosis, showing how easily the Edinburgh system can be adopted without material increase in expenditure.

When advocating any new agency in dealing with the prevention of infectious disease, the Medical Officer of Health must always keep in mind the fact that he has to convince a Council composed of laymen that the new scheme which he is bringing forward is not only of great benefit to the community, but also, and most particularly, that it will not materially increase the expenses already to be borne by the rate-

If we look at the means already at the disposal of some of our largest towns for the treatment of Pulmonary Tuberculosis, as taken from the latest available reports of their Medical Officers of Health, it will be seen that in several cases sanatoria and notification of phthisis are in existence but that, as confessed by more than one Medical Officer of Health, the work to be undertaken has outgrown the means at his disposal.

In Brighton the following factors are available for dealing with phthisis:-

1. Voluntary Notification
2. Disinfection of houses.
3. Sanatorium treatment for 25 patients at a time at the Borough Fever Hospital. Preference is given to those patients who have not at home a bedroom to themselves. Both early and comparatively advanced cases are admitted.
4. Visitation of notified cases at their homes at regular intervals by a sanitary inspector.

In Birmingham the Medical Officer has the following means at his disposal:

1. Voluntary Notification.
2. Disinfection of houses, bedding etc.
3. Sanatorium in course of ereetion for 40 patients, only early cases to be admitted.
4. Notified cases visited and advised by an official of the Health Department.

In Manchester the means of dealing with this disease are as follows:

1. Voluntary Notification
2. Disinfection of houses, bedding etc.
3. Supply of sputum flasks.
4. Crossley Sanatorium for early cases.
5. Clayton Hospital for Advanced Cases.
6. Notified cases visited and advised by an official of the Health Department.

Liverpool also possesses much the same means of dealing with phthisis, viz:-

1. Voluntary Notification.
2. Disinfection of rooms and bedding.
3. Notified cases visited & advised by a member of sanitary staff.
4. 70 beds at Mount Pleasant Consumption Hospital
   24 beds at Heswall Sanatorium
   50 beds at Fazakerley Hospital
   ? beds at Delamere Forest Sanatorium.
5. Various general dispensaries throughout the city.

In all the above towns sputum examinations are also undertaken free of charge by the Corporation.

Consideration of the methods employed in these four large towns will bring clearly before one the the enormous scope of the work undertaken in dealing with phthisis. It must be borne in mind that these four towns exhibit what is at present in England probably the high-water mark of preventive medicine as applied to phthisis. Many of the smaller towns in England are now making efforts to combat the ravages of tuberculosis, and as a general rule are proceeding in the paths already made manifest by the larger and more wealthy corporations.

The general measures undertaken, are, when considered individually, of undeniable importance, but it is open to question whether the maximum benefit is at present being derived from them. The organization of all the different factors involved means an immense tax upon the time, and energy, of the Medical Officer of Health and his Staff, and already more than one Medical Officer of Health seems to think that the limit has been reached of what can reasonably be

expected from the staff at his disposal. Thus Dr. Niven (1) of Manchester writes as follows: "The "work is outgrowing the machinery provided to cope "with it, and as pointed out in previous reports, "there are serious obstacles to progress."

What appears to be necessary now is a headquarters organization of devoted entirely to the work against phthisis; a sun-wheel around which all the planet-wheels may revolve, and upon which they may be dependent for their activity.

The Tuberculosis Dispensary as evolved by Dr. Philip certainly fills this position. At present in most towns all the administrative work in connection with tuberculosis is performed at the office of the Medical Officer of Health, and thereby immensely complicates the working of his department. It is here that all notifications are received, all instructions as to visiting cases are issued, all orders for disinfection of bedding, and houses, are given to the disinfecters, and all arrangements regarding removal of cases to sanatorium or hospital are considered.

This must of necessity entail a great increase and complexity of the usual work of the health department, and moreover it cannot receive the attention as a separate unit which it deserves and requires.

The need for a separate centre for the complete control of the organization against phthisis is manifest. Where a Tuberculosis Dispensary is in existence it will form the central bureau and to it all information regarding phthisis will be directed.

(1) Annual Report of the M.O.H. for Manchester 1908.

It is not our intention here to enumerate the varioud duties which devolve upon the Dispensary, suffice it to say that it should in addition to being a curative and educative institution be the place where all the organizing factors previously mentioned as devolving on the office of the Medical Officer of Health should be dealt with. There is one possible exception to this, namely, the instruction of the disinfecters. In a very few towns will it be possible to have a man devoting his time exclusively to disinfecting tuberculous houses etc. It would be a simple matter however to send information from the Dispensary to the Public Health Office as to what houses required disinfection.

It will be seen from the measures utilised against phthisis in the various towns given above, that in every case all the essential factors of the Edinburgh system are in evidence to a greater or less extent, with the one notable exception of the Tuberculosis Dispensary. This is to be regretted as its value in the system cannot be over-estimated, and the extra expenditure incurred by the rate-payers is not excessive. As was pointed out earlier there should be an assistant to the Medical Officer of Health devoting his time entirely to tuberculosis and especially the tuberculosis dispensary. Where practicable he might also be resident physician at the Corporation sanatorium if within reasonable distance. The centralizing of all the efforts in the Dispensary, where phthisis is the one and only thought, would be found to

give much better results, and tend to much easier working than centralizing them in the office of the Medical Officer of Health, where phthisis is only one of numerous important matters.

Any Medical Officer of Health of one of our larger towns who contemplates recommending the establishment of a municipal tuberculosis Dispensary to his Committee will not have a very great expense to face. It may, or may not, depending on the size of the town, be necessary to appoint a whole time Medical Officer to the Dispensary. He can transfer his present tuberculosis nurse or health visitor entirely to the dispensary, and he may, if necessary, delegate one of his clerks to be present for so many hours daily at the dispensary. The building and equipment will of course entail some expense, but where low expenditure is an essential it will be possible to economise in numerous ways, when the dispensary is managed in conjunction with the Public Health Department.

P O S T S C R I P T.

We have now considered what is more or less an ideal scheme, at least as ideal as can be conscientiously proposed to any local authority without going to any extreme expense. If, however any local authority wishes to wage war against the bacillus of tubercle it must necessarily be prepared to lay out a certain amount of money on the process, otherwise it were almost better left alone. The half hearted measures in vogue in most municipalities in this country, and

the slight and grudging recognition given by town Councillors to the gravity of the problem, have much to do with the continuance of the disease.

When one considers the mortality from Scarlet Fever and diphtheria, and the amount of municipal funds expended in their prevention and treatment, compared with the mortality from tuberculosis, and the mere pittance granted for its prevention, it is indeed food for reflection.

The usual thing that, with one or two notable exceptions, one finds is, that the medical officer of health has been able to obtain the use of perhaps 20 beds in the local fever hospital for either (1) The accommodation of dying and advanced cases of tuberculosis, or (2) The treatment of early cases, and this treatment is in most cases, as in the Brighton system, confined to a few weeks' residence in the hospital, during which the patient is taught how to look after and treat himself, and is then discharged to continue the treatment at home.

There is a silver lining to this cloud, however, in that at last the public are beginning to realise the gravity of the situation, and it is to be hoped that soon they may return men to their town councils who will be prepared to do something adequate to meet this crying evil.

In the words of the late King Edward VII: "If preventable, why not prevented?"

CONCLUSIONS.

I. THAT the disease tuberculosis of the lungs is essentially an infectious disease and should be treated as such.

II. THAT the infection may be derived from both human and bovine sources.

III. THAT the human source is the more important.

IV. THAT the disease itself is not hereditary but that a pre-disposition to the disease is.

V. THAT the disease tuberculosis of the lungs is not a bacteriaemia.

VI. THAT tuberculosis of the lungs is even more prevalent than is commonly supposed.

VII. THAT it is almost impossible to form an accurate estimate of the number of persons suffering from pulmonary tuberculosis.

VIII. THAT both sexes are almost equally prone to develop the disease.

IX. THAT no age is exempt from the disease but that the majority of deaths occur between the ages of 35 and 45.

X. THAT no climate is absolutely antagonistic to the disease, and that tuberculosis may be treated as successfully in this country as abroad.

XI. THAT if this disease is to be controlled satisfactorily, all means of infection must be minimised to as great an extent as possible.

XII. THAT great care should be given to the supervision of milk and meat supplies, especially the former.

XIII. THAT efficient ventilation and air-space should be provided in all living and working rooms.

XIV. THAT each municipality should undertake a systematic control of human consumptives.

XV. THAT such control should consist of:-

1). Notification of the disease.

2). Provision of (a). A Sanatorium for early cases.

(b). A hospital for advanced cases.

(c). A tuberculosis dispensary.

3). Disinfection of infected houses.

XVI. THAT the adoption of such control in large towns should not entail a great increase of expenditure on the part of the rate-payers.

XVII. THAT the Medical Officer of Health should have control over all branches of the anti-tuberculosis programme.

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